Workshop 1: Professional Development for Scholars-in-Training: What career options do I have in BER?

Lead Facilitator: DBERSiT (Discipline-Based Education Research Scholars-in-Training)

Contact: Brie Tripp (tripp@pdx.edu)

9:30 am – 12:00 pm, graduate students and post-docs only, $0

ABSTRACT

As graduate students and postdoctoral researchers, we are at the beginning of our careers in the ever-growing field of Biology and Biology Education Research. Where do we go from here? How do we navigate the job market? We are often confronted with these questions as the end date to finishing our degree or position approaches. This professional development workshop aims to ease some of the anxiety and provide insight and guidance on future career options: from traditional research careers, teaching track/community college options, and evaluation centers to science communication and policy involvement. We invite participants to join us in a workshop with panelists that can speak to the benefits, challenges, and opportunities of traditional Discipline-Based Education Research routes as well as career opportunities outside of academia.

Panelists will share their experiences in their current position (1-hour time duration): how they got there, what they did right, what they wish they would have done differently, and address questions that participants may have regarding future career choices. This will be followed by break-out sessions/rotations with the five panelists where participants can receive more detailed information and probe panelists for knowledge and feedback (1.5-hour time duration).

PARTICIPANT OUTCOMES

- Gain a better understanding of career options available to those with a graduate degree or other training in BER
- Obtain insight on the “do’s and don’ts” of the BER job market
- Gain ideas about how to obtain a job in their desired field
- Gain a better understanding of how to maintain a healthy work/life balance

PANELISTS: Jeff Schinske, Holly Menninger, Christina Peterson, Brian Sato, and Marjee Chmiel

Jeff Schinske
Jeff Schinske is a biology instructor and the anatomy and physiology course coordinator at Foothill College (San Francisco Bay Area) where he conducts research on equity and inclusion in science classrooms. He leads two federal grant programs: The Scientist Spotlights Initiative, which supports the development and dissemination of inclusive biology curricula, and CC Bio INSITES, which empowers community college biology faculty to conduct and publish education research. Jeff has authored numerous high-profile biology education research articles, is a steering committee member for the Society for the Advancement of Biology Education Research (SABER), and was the 2018 recipient of the national Outstanding Undergraduate Science Teaching Award from the Society for College Science Teachers.

Holly Menninger
Dr. Holly Menninger is the director of public engagement and science learning at the Bell Museum on the St. Paul Campus of the University of Minnesota. Dr. Menninger earned her bachelor’s degree in biology from Denison University and her Ph.D. in ecology from the University of Maryland. During this time, she appeared on CNN’s American Morning talking about cicadas, mosquitoes, and other insects. After her Ph.D. she worked with federal and state policymakers as a senior public affairs associate with the American Institute of Biological Sciences. Prior to her work at the Bell Museum, Dr. Menninger worked in natural resources extension at Cornell University, co-hosted a radio show, led a large citizen science program focused on the biodiversity in our daily lives, and was the inaugural Director of Public Science for the College of Sciences at NC State University.

Christina Petersen
Dr. Christina Petersen is an Education Program Specialist in the Center for Educational Innovation at the

University of Minnesota—Twin Cities. Christina works with faculty, departments, and colleges to design courses to promote student learning using evidence-based approaches. Her teaching experience includes courses in undergraduate biology and pedagogical courses. Dr. Petersen's current research focuses on identifying best practices for teaching in active learning classrooms. She has a Ph.D. in Pharmacology from Vanderbilt University and a BS in Zoology from the University of Wisconsin.

Brian Sato
Dr. Brian Sato is an Associate Teaching Professor in the School of Biological Sciences at the University of California, Irvine. He also is the Interim Associate Dean of the Division of Teaching Excellence and Innovation. His research aims to improve STEM education at the undergraduate level. One project explores the impact of instructor exam feedback on students' understanding of the content. Another project examines how teaching faculty can be change agents to improve STEM education across the University of California system. Dr. Sato received his Ph.D. in Cell Biology at the University of California, San Diego.

Marjee Chmiel
Dr. Marjee Chmiel is the Director of Evaluation for Howard Hughes Medical Institute (HHMI) Tangled Bank Studios ad HHMI Biointeractive, where she works on evaluation efforts, organizational learning, and effective philanthropy across a variety of programs and initiatives. She is a social science researcher with expertise in science education, educational media, and research and evaluation methods. Dr. Chmiel's work reflects her passion to reach and educate all individuals through multi-media experiences. Dr. Chmiel has created educational science games for the Jason Project with National Geographic and worked for PBS on an online professional development program for teachers. Dr. Chmiel earned her bachelor's degree in broad field science & chemistry and her Master's in educational policy & leadership from Marquette University. She earned her Ph.D. at George Mason University where she specialized in educational research and evaluation methods. She also serves as an adjunct professor with the University of Maryland's School of Information where she teaches courses in research and evaluation.

Workshop 2: Bringing a Research Lens into Teaching

Lead Facilitator: Katelyn Southard (ksouthard@email.arizona.edu)

8:30 am – 12:30 pm, $35

ABSTRACT

Adopting a research lens in the classroom can be a difficult process for many instructors interested in conducting research in their own classroom settings. Many faculty members who are interested in discipline-based education research (DBER) may be excited to make transformative changes in their classrooms, share interesting approaches to well-known instructional problems, or communicate interesting patterns in student thinking on a particular topic, but might be doing so based on "hunches" or student perspective feedback. The goal of this workshop is to provide insight into DBER methodologies for instructors at the beginning stages of pursuing research questions in their own instructional settings. We will provide some initial training in collecting and analyzing quality evidence of student thinking from within the classroom setting in order to inform a particular research question or learning process. This workshop is geared toward 1) individuals who are interested in starting biology education research but are approaching it for the first time in their own classrooms, or 2) individuals who are currently teaching and would like input on how to use evidence of student thinking patterns from their own classrooms to improve their instructional practices.
Workshop activities will center on a case-based approach to 1) defining research goals, 2) evaluating evidence of student learning using a variety of research methods 3) analyzing collected data by focusing on underlying student reasoning patterns, and 4) considering possible actions based on the evidence collected. Participants will spend time dissecting examples and considering how these principles can be applied to their own DBER work. Small- and large-group discussions will provide opportunities for participants to practice evaluating research questions in alignment with target goals for investigation, consider the benefits and limitations of common DBER data collection and analysis methodologies (both quantitative and qualitative), practice implementing a coding scheme and coming to consensus, and make decisions about next steps based on results. Case-based small-group activities and personal reflection activities will stress the importance of focusing on student reasoning patterns rather than evaluation of ideas for "correctness." Additionally, the design of the case-based scenarios and discussions will highlight essential mindsets for transitioning from an instructor-centric classroom approach to using a research-based mindset in which eliciting student ideas, making student thinking visible, collecting evidence of thinking patterns, and making evidence-based instructional decisions are prioritized. These mindset shifts are important whether the participant's goal is to begin a DBER study or to simply improve opportunities for learning in their classrooms by using evidence of student thinking.

PARTICIPATE OUTCOMES

Through participating in the "Bringing a Research Lens into Teaching" workshop, participants will be able to:

1. Identify methods of collecting student thinking that align with research goals.
2. Compare the differences between interpreting student thinking patterns versus evaluating student answers for "correctness."
3. Reflect on the potential benefits of focusing on student thinking in research and teaching.
4. Apply what they have learned to specific cases.

PARTICIPANT ENGAGEMENT

Workshop activities will focus on actively engaging participants in evaluating case-based scenarios of DBER research in classrooms. These scenarios will highlight a variety of evidence-based tools and strategies for collecting and analyzing student reasoning in the classroom. In small groups, participants will work to evaluate scenarios by focusing on 1) defining quality research goals, 2) evaluating evidence of student reasoning patterns, 3) applying evidence-based DBER research tools and methodologies, 4) analyzing data for underlying patterns, and 5) considering possible actions and outcomes based on research results.

Small- and large-group discussions will focus on analyzing patterns in student thinking by noticing key elements of reasoning, creating interpretations of critical features and common patterns in collected evidence, and responsively acting based on results. Specifically, groups will be asked to analyze hypothetical data sets in small groups, while focusing on distinguishing between underlying reasoning patterns vs. potentially distracting variables in the data, and exploring the alignment between the observed results and the research aims. The case-based scenarios will underscore the value of focusing on student reasoning patterns in conducting DBER research and will show differences between teacher-centric evaluative approaches to analysis and learner-centric interpretive approaches to uncovering reasoning patterns in collect student work.
Reflection activities will provide participants with the opportunity to voice ideas for their own classroom research and engage in actively providing and receiving specific feedback on these ideas. To assess workshop learning outcomes and to allow participants additional practice, the workshop will close with a small group activity that assesses the participants' ability to transfer the principles used in the workshop to their own unique settings.

Katelyn Southard
Dr. Katelyn Southard received her BER-focused PhD from the University of Arizona in the Department of Molecular and Cellular Biology. Her primary areas of research focus include understanding undergraduate biology students' ideas about molecular mechanisms and improving learning opportunities for students in large-enrollment STEM courses through use of effective instructional teams. Katie served as program coordinator, facilitator, and presenter for the HHMI/NAS Mountain West Regional Summer Institute on Undergraduate Education in Biology (2011-2015). Currently, she is an Assistant Research Scientist at UA for the NSF-IUSE project Developing Instructional Teams for Evidence-Based Instruction in Large Collaborative Learning Environments, where she leads research focusing on evaluating a new model for effective use of instructional teams to increase learning opportunities for students in undergraduate STEM courses.

Jonathan Cox
Dr. Jonathan Cox received his PhD in Epidemiology from Yale University. His interest in teaching and learning was sparked during a Postdoctoral Excellence in Research and Teaching fellowship, part of the NIH's IRACDA program, at the University of Arizona. He transitioned out of basic epidemiology research and moved entirely into undergraduate education after joining the UA's AAU Undergraduate STEM Education Leadership Team. He has extensive experience working with faculty training and evaluation projects across the UA campus. For example, he worked with faculty to establish common learning objectives across an introductory biology curriculum and evaluated the implementation of the Chemical Thinking curriculum serving roughly 2500 students per year. He has taught in-person and online introductory courses including molecular and cellular biology and epidemiology courses. Currently, as a Research Associate for the same NSF-IUSE project, he leads professional development for participating STEM faculty and student teams.

Workshop 3: Combining forces to use assessment to promote enduring quantitative reasoning curricular reform

Lead Facilitator: Liz Stanhope (stanhope@lclark.edu)

8:30 am – 12:30 pm, $35

ABSTRACT

This workshop will assist participants in contributing to meaningful efforts to foster evidence-based curricular change around improving quantitative reasoning in biology. Vision & Change highlighted the importance of quantitative reasoning for 21st-century biologists. As biology departments work to implement curricular changes there are natural questions that arise about the impact of these changes on student learning. Yet, too often questions of assessment begin and end with individual students. Also, several instruments have been developed to assess students' quantitative skills and reasoning. While each of these tools may provide useful data, they are all slightly different in nature. Departments are left confronted with the challenges of figuring out which assessments are useful for their purposes and how to use assessment data to promote larger-scale, enduring change in departments.

Unlike a traditional workshop, the facilitators see themselves as involved in an ongoing quest to address these issues. While participants will leave with additional skills, we also seek to develop a stronger, more cohesive community of people who will work together to advance our knowledge about assessing quantitative thinking skills in the context of biology and using such assessment data to foster curricular improvement.

The facilitators will discuss the development of an instrument (the BioSQuaRE) to assess quantitative reasoning in the context of biology, and will share their experiences implementing and evaluating curricular change at their institutions. Workshop participants are encouraged to do the same, in the spirit of building a community of practice. While the workshop will not provide participants with a magic bullet to resolve all assessment woes, we hope that at the end of this workshop we will have identified a set of resources and a vision for how we can collaborate to strengthen the use of assessment in effecting lasting improvements in how we prepare biology students for increasingly quantitative careers.

PARTICIPANT OUTCOMES

- Gain familiarity with several assessment instruments that evaluate quantitative reasoning.
- Understand a model of data driven department level curricular assessment.
- Learn from peers about challenges and successes in using assessment to further curricular reform around quantitative skills.

WORKSHOP TIMELINE AND DESCRIPTION OF ACTIVITIES

0:00 - 0:10 (seats arranged in a circle) Facilitators welcome participants and outline the goals and format of the workshop.

0:10 - 0:20 (seats arranged in a circle, moved slightly into pairs) With seats arranged in a circle, facilitators and participants divide into pairs to exchange five-minute introductions. In these introductions, pairs must learn the name, department and home institution of each other, as well as their motivation in attending the workshop.

0:20 - 0:50 (seats arranged in a circle) Each member of a pair gives a one-minute introduction of the other member of the pair, including the information specified in the previous activity.

0:50 - 1:25 (move into small group arrangements) Small group discussions on specific themes, Round 1. One facilitator will be in each group. Topics might require slight adjustment depending on goals revealed during introductions.

(1) Existing assessments (Biosquare, TOSLES, QLRA, Math-Biology Values Instrument, Calc/Bio Concept Inventory)
(2) Department level assessment of curriculum.

(3) Assessment instrument development.
(4) Building and analyzing data sets to assess curricular change

1:30 - 1:55 (still small group arrangements)Small group discussions on specific themes, Round 1. Same themes, new groups.

2:00 - 2:15 Break, snacks, informal conversation

2:15 - 2:50 (seats arranged in a circle) Reflection and synthesis. Dreaming big: Have we succeeded in raising the QR skills of our students since 2010? What are our successes? What are our challenges? What resources and actions would help us as a community of practice move from challenges to successes?

2:50 - 3:00 Conclusion of workshop by facilitators.

PARTICIPANT ENGAGEMENT

As seen in the timeline, our workshop seeks to combine our collective experience into a vision for furthering QR skills in biology majors. The introductory activity will help participants and facilitators network around topics of common interest. Small group discussions will provide a setting to swap techniques and deepen understanding of common challenges. During the synthesis discussion facilitators will try to find themes in the collective knowledge in the room that we can record and build from. Although facilitators expect to share their experience with participants, we view ourselves as peers within the workshop. Participant participation is essential to the success of this workshop, and we hope to maintain connections with participants as we continue our work throughout the academic year.

Erik Larson
Erik Larson is a professor of sociology at Macalester College. Building on his multimethod research, he has more than a decade of experience in working on a variety of assessment activities linked with curricular change at both institutional and multi-institutional levels. His contributions include research design, data analysis, reporting, and developing strategies to implement findings of assessment activities.

Kristine Grayson
Kristine Grayson is an Assistant Professor of Biology at University of Richmond. She has taught at all levels of the Biology curriculum, with particular contributions to the redesign of the third semester of introductory biology (ecology/evolution/physiology) to align with recommendations from Vision and Change. She contributes to the collection and organization of several national assessment instruments in her department. Kristine is an HHMI BioInteractive Ambassador, and Faculty Mentoring Network facilitator with the Quantitative Undergraduate Biology Education and Synthesis project. Her interests include the use and accessibility of data-centric teaching resources for Biology classrooms.

Paul Overvoorde
Paul Overvoorde is the Associate Dean of the Faculty at Macalester College, and also a Professor of Biology there. He is a member of the consortium that developed the Biological Science Quantitative Reasoning exam. He supervises the Assessment Office and various assessment activities at Macalester. He has served as Program Director for an HHMI Undergraduate Science Education Grant.

Liz Stanhope
Liz Stanhope is an associate professor of Mathematics at Lewis & Clark College. She is a member of the consortium that developed the Biological Science Quantitative Reasoning exam. She is a member of PKAL and has attended the PKAL STEM Leadership Institute. She has served as Program Director for an HHMI Undergraduate Science Education Grant. She also regularly teaches a 100-level hybrid biology/calculus/statistics course that she developed in collaboration with biology faculty members.

Andrew Zieffler
Andrew Zieffler is a Senior Lecturer and researcher in the Quantitative Methods in Education program within the Department of Educational Psychology at the University of Minnesota. He is a member of the consortium that developed the Biological Science Quantitative Reasoning exam. He has authored/co-authored several papers and book chapters related to statistics education, and has been a co-PI on many NSF-funded statistics

education research projects. He serves as a member of the Research Advisory Board for the Consortium for the Advancement of Undergraduate Statistics Education (CAUSE).