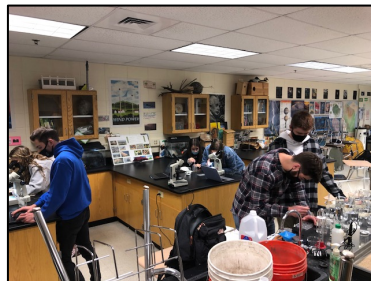


Empowering Pre-service Teachers and Students With Environmental Health Research

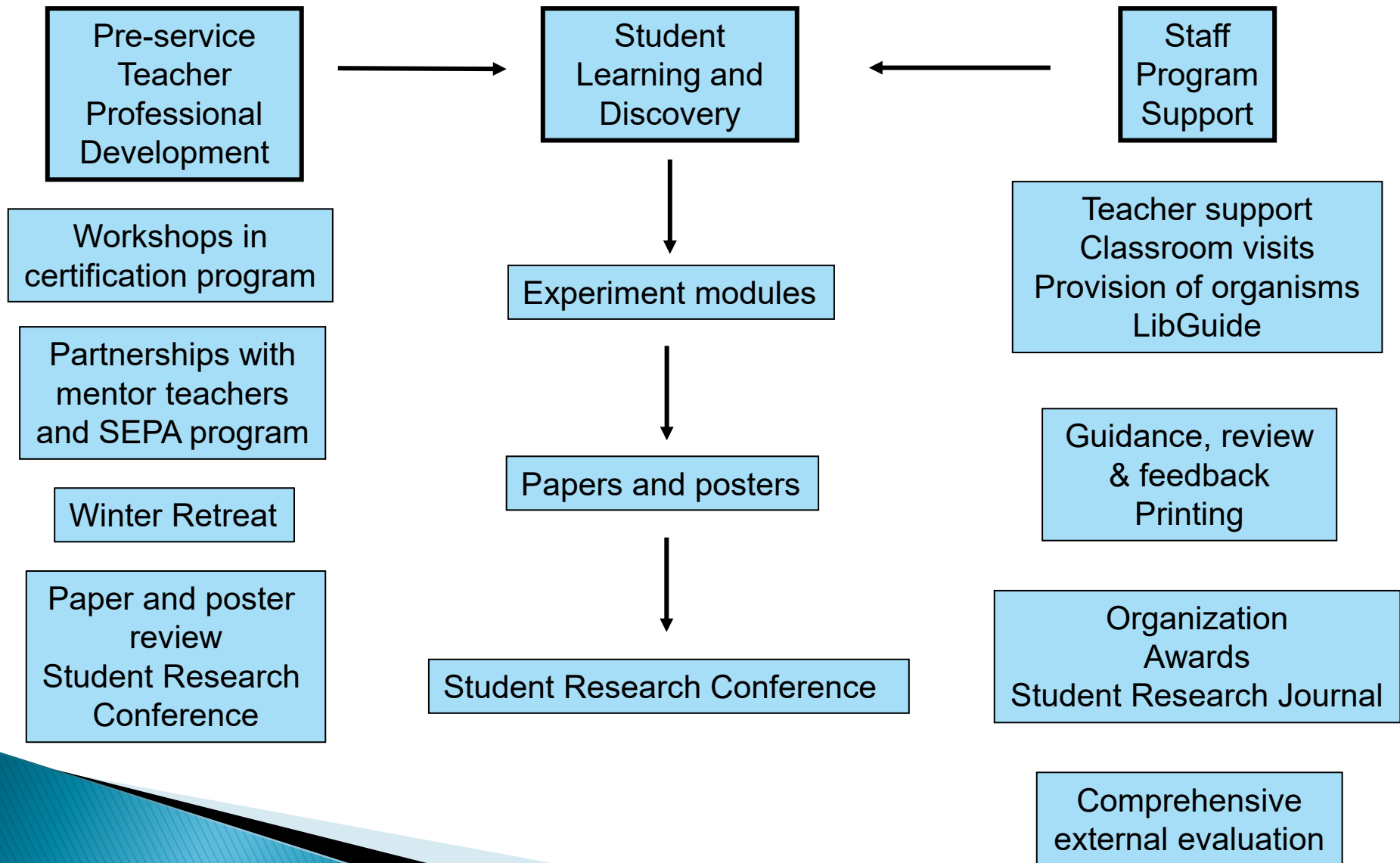
David Petering (petering@uwm.edu) and
Craig Berg (caberg@uwm.edu), Co-Principal Investigators
Renee Hesselbach (hesselba@uwm.edu), Outreach Specialist
University of Wisconsin – Milwaukee



The underlying goal of the UW-Milwaukee SEPA grant is to prepare pre-service teachers to introduce inquiry/research into their teaching that connects concepts in life science to related issues in environmental health and thereby addressing the NGSS standards. The significance of this program is that it combines pre-service teacher professional development, under the mentorship of master teachers, with student activities that involve in-depth authentic experimentation.

This project was supported by the National Institute of General Medical Sciences, the National Institutes of Health under Award Number GM129191. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

2016-2021 WInSTEP SEPA Program



Science Content and Program Modifications - Modules

ZEBRAFISH AS MODELS: STUDYING THE EFFECTS OF ENVIRONMENTAL AGENTS ON HUMAN HEALTH

Using zebrafish as models, students examine the development of zebrafish embryos and malformations that occur due to exposure to various environmental toxicants.

- An innovative online image repository was created for the zebrafish module



NERVE AND MUSCULAR BASIS OF EARTHWORM MOVEMENTS *Effects of Physical and Chemical Environmental Agents*

This module investigates the use of earthworms as a model organism for studying neurotoxic effects on the human nervous system.

- Workshop kits were mailed to pre-service teachers so they could actively participate in the virtual workshops from home
- In collaboration with the UWM film department, videos were produced for the earthworm and fathead minnow modules to adapt them to a virtual experiment experience

THE EFFECTS OF LEAD EXPOSURE ON FATHEAD MINNOW *Connecting Behavior and Physiology*

This module is a hands-on investigation of the effects of lead on fathead minnow reproductive behaviors. Students observe normal and abnormal breeding behaviors of fathead minnows and learn how changes in these behaviors are related to changes in fish physiology due to exposure to lead.



EFFECTS OF TOXIC CHEMICALS ON LEARNING AND MEMORY *Using Fish as a Model for Human Environmental Health*

This hands-on module uses zebrafish or fathead minnows as models for the effects of lead by using an experimental protocol that is flexible so that a variety of student-directed questions can be answered with fish in a T-maze.

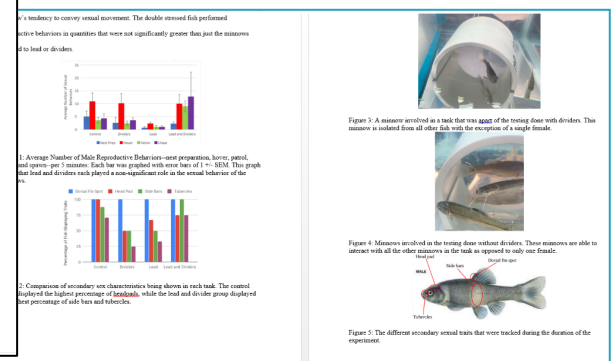
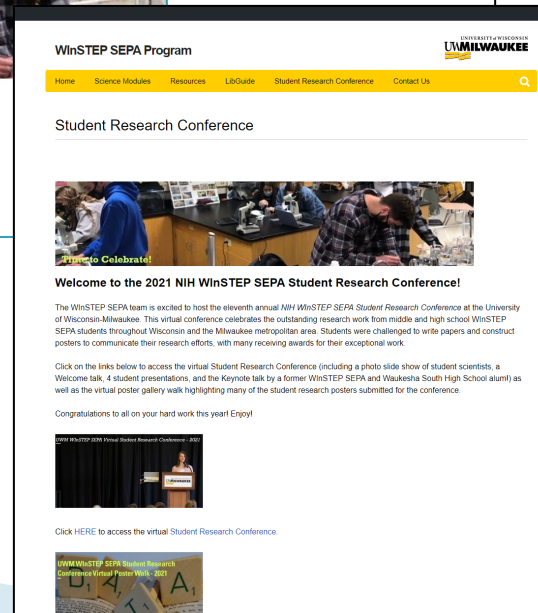
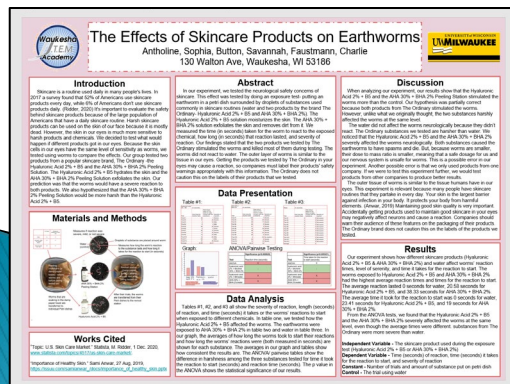
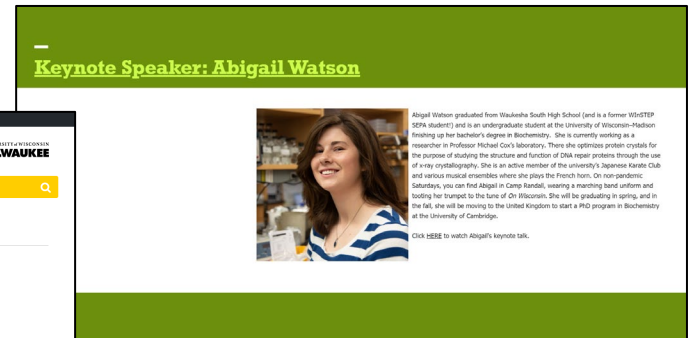
- All program and supplemental materials are available on our LibGuide:

<https://guides.library.uwm.edu/sepa>

Scientific Communication – Student Research Conference

Event was held virtually in spring 2021 and is available on demand (<https://sites.uwm.edu/winstep/student-research-conference/>) so schools have maximum flexibility to participate:

- Annual culminating event highlighting the research activities of participating students
- 11 schools participated
- Papers (36) and posters (107) were reviewed collaboratively by WInSTEP staff and pre-service teachers
- 71 posters were highlighted in an online poster walk (Sway) and award winning papers and posters are showcased on the WInSTEP program website
- Videos were produced and uploaded of (i) the Welcome talk by a distinguished scientist, (ii) the top 4 student paper presentations, and (iii) the keynote speaker talk, which features a former WInSTEP SEPA student who shares how her early research experiences in high school stimulated her to pursue a biochemistry major in college together with intense involvement in an undergraduate research project



Student Inquiry and Research Experience Evaluation Design and Sample Results

Utilizes a combination of formative and outcome measures and tools, adhering to National Science Education Standard positions on assessing science education. The evaluation documents the extent to which the SEPA program:

- Increases the knowledge of participating pre-service teachers about how the use of experiment modules involving environmental health problems can address the New Generation Science Standards (NGSS) and enhances teachers' ability to help stimulate inquiry/research in the classroom
- Enhances students' capability (1) to meet NGSS, (2) to understand life science content related to the modules, and (3) to understand environmental health science and the impact of the environment on health
- Results in diverse participation; leads to greater numbers of minority, low income, and female students in STEM education
- Has a sustained institutional impact on participating schools

During the 2019-2020 academic year, 623 students experienced the zebrafish and earthworm modules. Continuing WInSTEP teachers exposed an additional 873 students to the modules, for a total of 1,496 students (unduplicated). For the first 4 years of the grant, the program has reached 6,725 students. Results from Year 4 indicate:

- 2019 workshops were very well received by the pre-service teachers. The zebrafish module workshop received an overall GPA of 3.5/4.0, and the earthworm module workshop received an overall GPA of 3.8/4.0
- 100% of early career and mentor teachers rated the retreat as "excellent" or "very good"
- 100% of mentor teachers agreed that the zebrafish and earthworm modules improved their students' scientific and analytical skills
- Student opinions shifted significantly from pre- to post-tests for both modules that "seeing how an environmental agent affects fish/worms helps me understand that those same agents can also affect me"

Evaluation Consultant: Barbara Goldberg & Associates, LLC (barbaragoldb@gmail.com)