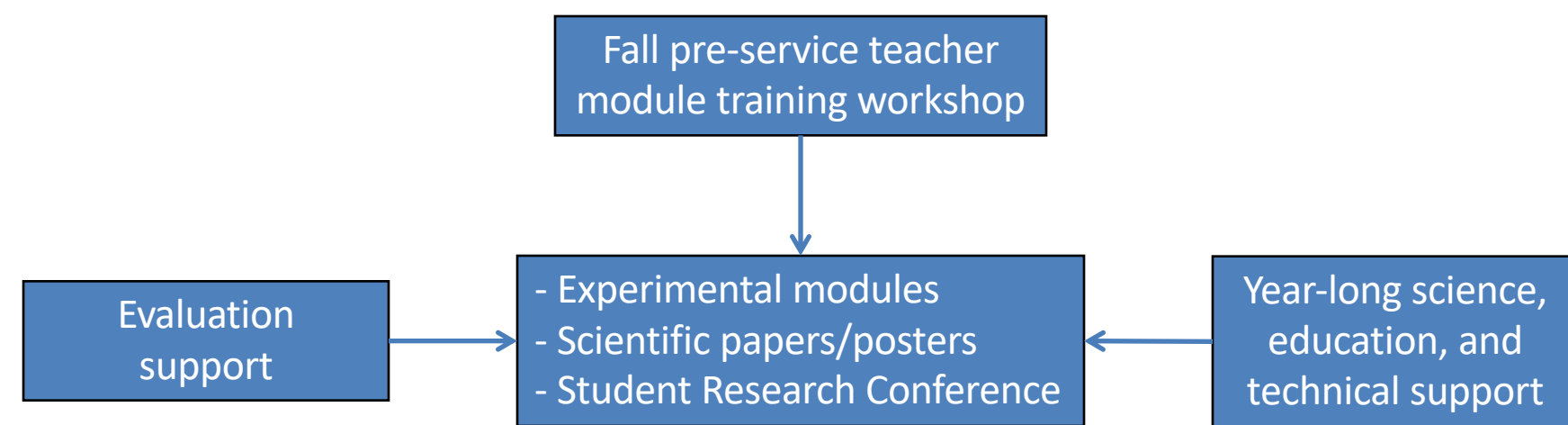


PROGRAM DESCRIPTION

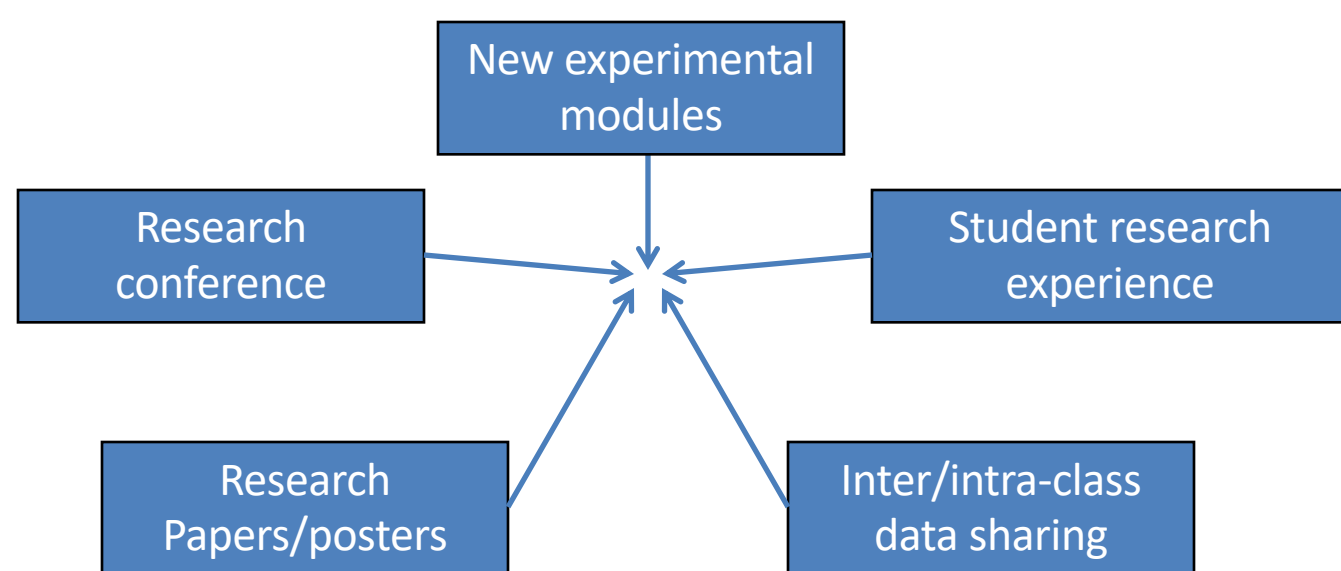
The underlying goal of the UW-Milwaukee SEPA grant is to prepare pre-service teachers to introduce inquiry/research into their teaching that connects concepts in life science to related issues in environmental health and thereby addressing the NGSS standards. The significance of this program is that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

PROJECT FORMAT



Combine pre-service teacher development and student science experiences that reinforce student learning and support the Next Generation Science Standards.

STUDENT SCIENCE LEARNING ACTIVITIES



SCIENCE CONTENT - MODULES

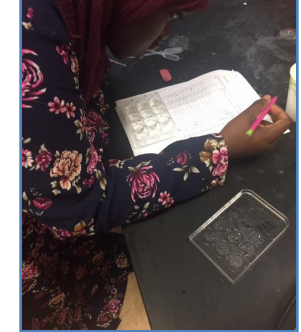
ZEBRAFISH AS MODELS: STUDYING THE EFFECTS OF ENVIRONMENTAL AGENTS ON HUMAN HEALTH

Effects of Ethanol, Nicotine, and Caffeine Exposure on Embryonic Development

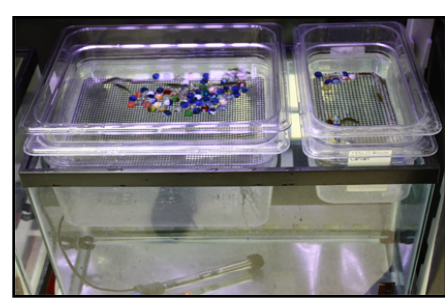
Using zebrafish as models, students examine the general development of zebrafish embryos and malformations that occur due to exposure to various environmental toxicants. By applying the results of the zebrafish embryo to human embryo development, students draw conclusions regarding personal health, environmental hazards, and the risks and benefits of personal and social decisions in relation to these hazards.



3 day old zebrafish embryo exposed to caffeine



Student Researcher



Breeding Aquarium

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. Students conduct various behavioral experiments exploring the concentration-dependent sensorimotor reactions of earthworms to pH and metal solutions, including how they are modified by the worm's physical environment. Finally, students examine how these responses relate to human health and the consequences of chemical exposure.

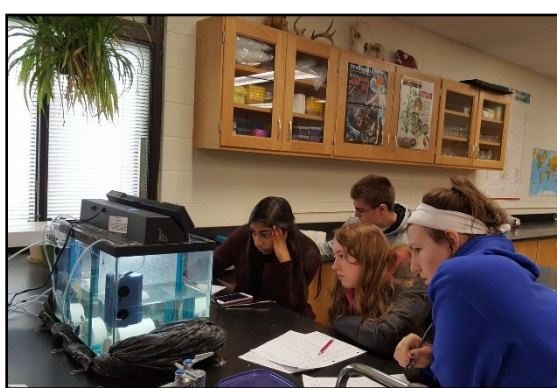


Student Researchers

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. In this module, students observe normal and abnormal breeding behaviors of fathead minnows, compare the effects of lead to mercury using a video-format experiment, learn how changes in these behaviors are related to changes in fish physiology due to exposure to lead, learn the efficacy of different methods of reducing lead exposure, and see the effects of embryonic exposure to lead on embryo growth and larval behavior. The results are then compared to what happens to humans exposed to lead or mercury, i.e., how are fish models of human environmental health.

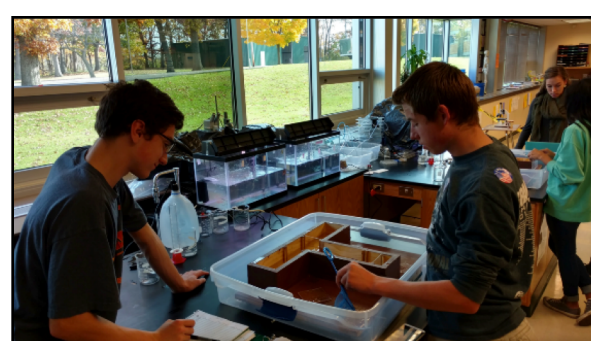


Student Researchers

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 (e.g., learning abilities of sexes, species, or age groups with or without chemical exposure. Students then examine how fish behavior relates to human health and the biological consequences of chemical exposure.



Student Researchers

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

PRE-SERVICE TEACHER WORKSHOP

To prepare pre-service teachers to effectively incorporate the inquiry-based modules into their curriculum, they participate in an intensive workshop at the UW-Milwaukee School of Freshwater Sciences. The workshop provides pre-service teachers with:

- a discussion of the scientific process
- an introduction to environmental health concepts
- an examination of responsible and ethical conduct of research
- hands-on training sessions of the zebrafish and worm experimental modules
- instruction on web and communication tools

In their student teaching, pre-service teachers are paired with master teachers who have experience doing the modules and together, they introduce them to their students. The master teachers serve as mentors who help support their effective transition to classroom teachers.



FALL RETREAT

To further support teacher success in the classroom, the WinSTEP program staff hosts a Fall Retreat for pre-/in-serve teams at the UWM School of Freshwater Sciences. The aims of the retreat are to build community, stimulate teacher input and exchange on the use of the modules, and share pedagogical ideas. Key topics covered include:

- responsible conduct of animals in research
- chemical hygiene and safety
- scientific papers and communication tools
- master teacher reflections panel
- nicotine and the e-cigarette epidemic, with a specific focus on incorporating e-cigarette toxicity into the zebrafish module
- ABT storymaking approach to research communication
- proposed WinSTEP Teacher Certification in Guided Inquiry Program



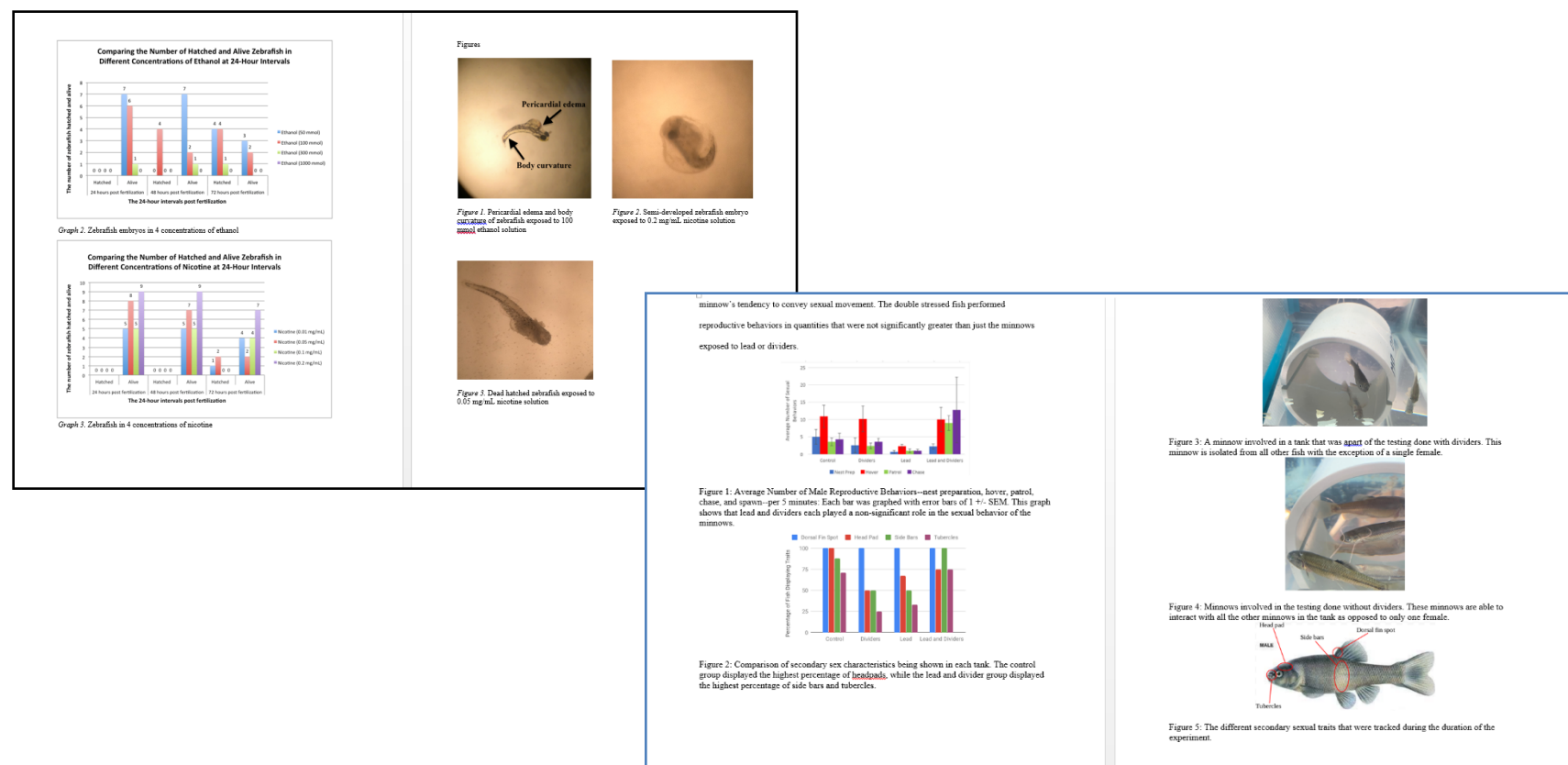
STUDENT PARTICIPATION IN THE SCIENTIFIC COMMUNITY EXPERIENCE

RESEARCH COMMUNICATION

Research Papers

Developing the skills to organize, synthesize, interpret, and communicate research in an orderly report is key for the dissemination of scientific information. Participating students are challenged to write research papers based on the WinSTEP SEPA experimental modules that include:

- relevant science content
- methodological detail
- experimental findings including various means of representation
- meaning or interpretation of the results

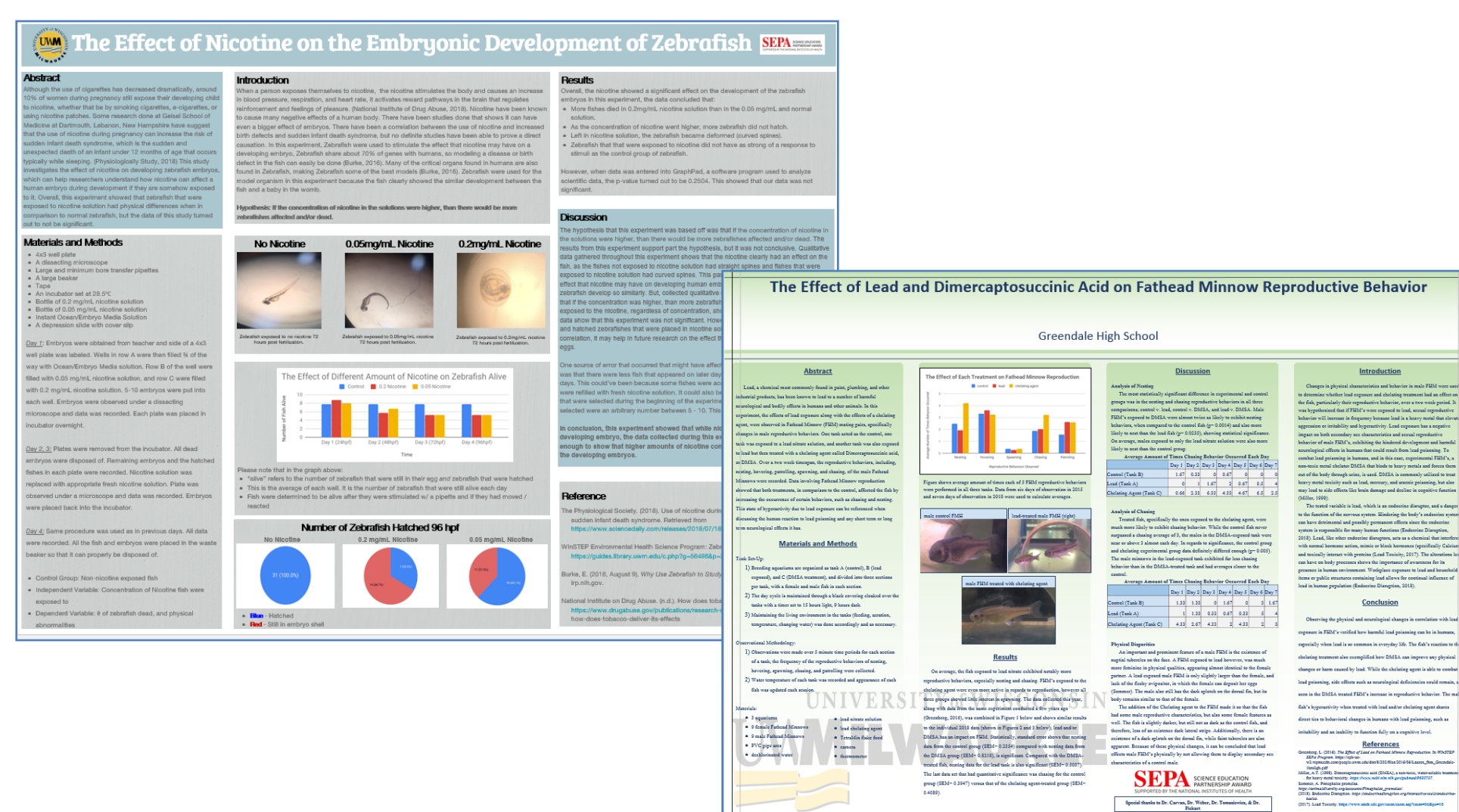


Papers are shared within and between classrooms to stimulate student reflection and discussion on the variety of experimental methods utilized, the range of results obtained, and the meaning of these results. The WinSTEP team, along with the pre-service teachers, also examine the papers much like a science journal reviewer.

Research Posters

In addition to writing research papers, students are encouraged to create scientific posters based on their SEPA research. Resulting student posters are displayed at the *WinSTEP SEPA Student Research Conference*, held annually in the spring.

Sample Student Research Posters:



STUDENT INQUIRY AND RESEARCH EXPERIENCE EVALUATION DESIGN

The evaluation process makes use of 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 with regard to race/ethnicity and gender among both pre-service teachers and students; leads to greater numbers of minority, low income, and female students in STEM education.
- Has a sustained institutional impact on participating schools

SEPA EVALUATION INSTRUMENTS

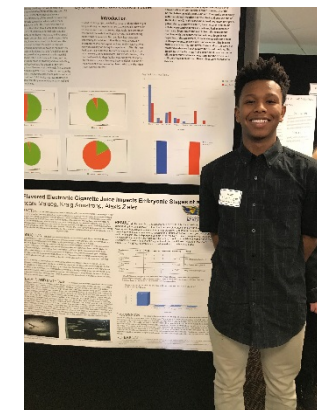
Instrument	Respondents	Description
Pre-Service Teacher and Early Career/Master Teacher Instruments		
Workshops and Retreat Surveys	WinSTEP Pre-service Teachers and Early Career/Master Teachers	Provide detailed feedback about the teacher development workshops and fall retreat
Mid-Year Focus Group	WinSTEP Pre-service and Early Career/Master Teachers	Provide pre-service and master teachers an opportunity to share experiences with the yearly program
Pre-service and Early Career/Master Teacher Follow-up Survey	WinSTEP Pre-service and Early Career/Master Teachers	Module specific online survey in which teachers report about their own experiences, student accomplishments, and reactions to the module
Student Research Conference Survey - Teachers	WinSTEP Pre-Service and Early Career/Master Teachers	Provide detailed feedback about various components of the Student Research Conference
Student Instruments		
Student "Report Card" Pre-Test/Post-Test Survey	WinSTEP Students	Measures knowledge gained and interest in and satisfaction with the modules and science classes
Student Research Conference – Student "Report Card"	WinSTEP Students	Measures student satisfaction with various components of the Student Research Conference
Research Conference Observation	WinSTEP Students	Evaluators conduct structured observations of the Student Research Conference
Additional Measurements		
Additional Measurements	WinSTEP Pre-Service and Master Teachers and Students	Program records, including aggregate number and demographic characteristics of pre-service and master teachers and students; educational level of participants; STEM content; number of higher level courses; documentation of research papers, participation in conference, etc.

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

2019 WinSTEP SEPA STUDENT RESEARCH CONFERENCE

APRIL 9, 2019

To highlight the research activities of the participating middle and high school students and teachers, the WinSTEP SEPA team hosted a student research conference at UWM. This culminating event was patterned after typical professional scientific meetings, and featured the top student research papers and posters. *At this year's conference, 16 schools participated with over 620 students and teachers from middle and high schools throughout Wisconsin.*



Student Poster Presenter



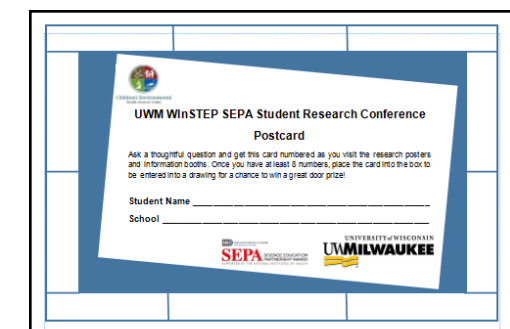
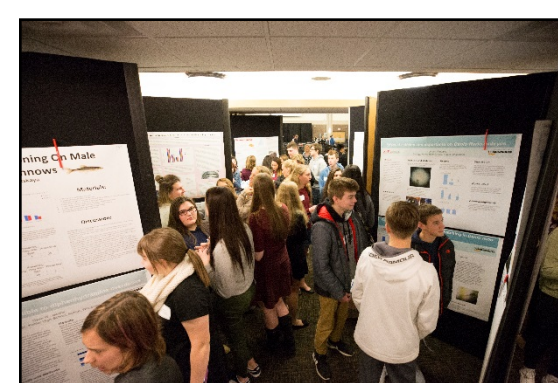
Student Artwork



Program Booths and Posters

For the 2019 conference:

- 169 student research posters were submitted, evaluated and presented
- 130 student research papers were submitted and evaluated with the top 4 papers being presented at the conference



Student "Passport"

WinSTEP SEPA CONFERENCE SCHOOL PARTICIPANTS

Christ King School*
Germantown High School*
Lake Country Middle School*
Morgan Butler Middle School
Milwaukee Rufus King High School*
Seymour Community High School
Union Grove High School
Waukesha South High School*

Cudahy Middle School*
Greendale High School*
Mauston High School*
Milwaukee Hamilton High School*
Muskego High School*
South Milwaukee High School
Waukesha North High School
Waukesha STEM Academy*

* Schools that have hosted pre-service teachers who are now in the field, or schools with new early career teachers who have gone through the UWM WinSTEP SEPA program and are now currently teaching.

In addition, during the 2018-19 school year, the WinSTEP team worked extensively with two master teachers in the WinSTEP program to develop a new year-long Environmental Health science course, using the four WinSTEP modules as the backbone of the curriculum. This course was approved by the Milwaukee Public School (MPS) administration and is currently being piloted in two MPS high schools, which have large underrepresented and disadvantaged school populations.

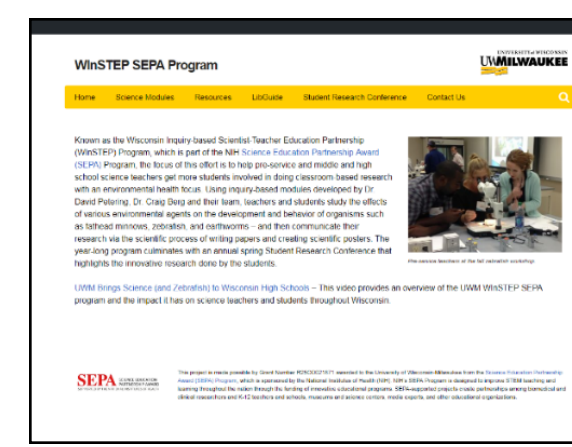
2017-2018 SAMPLE EVALUATION RESULTS

During the 2017-2018 academic year, 8 master teachers working with 15 pre-service teachers exposed 747 students to the zebrafish and earthworm modules. Continuing WinSTEP teachers exposed an additional 955 students to the modules, for a total of 1,702 students (unduplicated). For the first 2 years of the grant, the program has reached 3,545 students. Results from this group indicate:

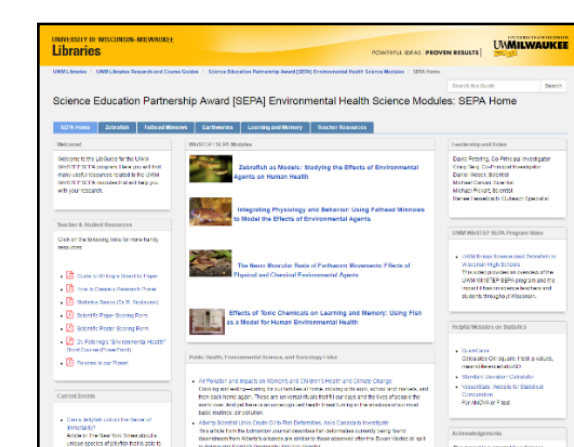
- 2018 workshops were very well received by the pre-service teachers. The zebrafish module workshop received an overall GPA of 3.8/4.0, and the earthworm module workshop received an overall GPA of 3.6/4.0
- 100% of pre-service teachers reported they gained new understanding and skills to teach middle and high school science having presented or observed the modules
- 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"
- 95% of students gave the 2018 Student Research Conference an overall grade of "A" or "B". 100% of teachers gave the conference an overall grade of "A"
- Overall, 23 schools participated in the WinSTEP program for the 2017-2018 school year.

PROGRAM WEBSITE AND LIBGUIDE

The WinSTEP website provides a portal for program teachers and students to access information about the: 1) program in general, 2) LibGuide, 3) curricular modules, 4) WinSTEP SEPA team member roles and contact information, 5) Student Research Conference and Online Journal, and 6) teacher and student resources.



WinSTEP Program Website



WinSTEP Program LibGuide

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