Empowering Pre-service Teachers and Students With Environmental Health Research

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PRE-SERVICE TEACHER WORKSHOP

To prepare pre-service teachers to effectively incorporate the toxicity-based modules into their curricula, they participate in an intensive workshop at the UW-Milwaukee School of Freshwater Sciences. This 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 together; they introduce them to their students. The master teachers serve as mentors who help support their effective transition to classroom teaching.

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:

[Image 1: Student Research Poster 1]

[Image 2: Student Research Poster 2]

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 Standards 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 experimental modules involving environmental health problems can address the Next Generation Science Standards (NGSS) and enhances teachers' ability to help stimulate discussions in the classroom.
- enhances students' ability to meet NGSS (2013) to understand life science content related to the modules, and (3) to understand environmental health science and the effects of pollutants on human health.
- results in diverse participation with regard to race/ethnicity and gender among study participants.
- leads to greater numbers of minority, low-income, and female students in STEM education.
- has a sustained institutional impact on participating schools.

STUDY DESIGN AND INNOVATION

The evaluation model for the SEPA project is an experimental design using pretest-posttest with multiple measures and tools. Sample Student Research Papers:

[Image 3: Sample Student Research Paper 1]

[Image 4: Sample Student Research Paper 2]

PROGRAM DESCRIPTION

The underlying goal of the UW-Milwaukee SEPA grant is to prepare pre-service teachers to introduce inquiry-based research into their teaching. It has been well-documented in the 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 experiential learning.

PROJECT FORMAT

Full pre-service teacher immersion program

Four-Session Summer Science Institute

A week-long science education, immersion support

8 one-day after-school experiences in Breeding Aquarium

SCIENCE CONTENT - MODULES

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

Effects of Stress, Nutrition, and Chemical Exposure on Organisms Development

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

Nerve and Muscular Basis of Earthworm Movements

Chemical Behavior and Physiology

This module investigates the use of earthworms as a model organism for studying neurochemical effects on the nervous system. Students conduct various behavioral experiments on earthworms for studying neurotoxic effects on the human nervous system. Students conduct various behavioral experiments on earthworms for studying neurotoxic effects on the human nervous system.

THE EFFECTS OF LEAD EXPOSURE ON FETAL MINGNOUS

This module is a hands-on investigation of the effects of lead on fetal minnow reproductive behavior. In this module, students observe normal and abnormal breeding behaviors of freshwater minnows, compare the effects of lead to mercury using a video format experiment, learn how these changes in these behaviors are related to changes in fish physiology due to levels of lead, learn the effects of different methods of reducing lead exposure, and see the effects of embryonic exposure on lead to embryonic growth and larval behavior. The results are then compared to what happens to humans exposed to lead or mercury, i.e., how does human health and the biological consequences of chemical exposure.

EFFECTS OF TOXIC CHEMICALS ON LEARNING AND MEMORY

Using fish as a Model for Human Environmental Health

The hands-on module uses zebrafish or freshwater 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 assessed with fish in 4 to 5 hr. 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.