



DELAWARE GK-12: INTEGRATING RESEARCH INTO SCIENCE CLASSROOMS IN VO-TECH HIGH SCHOOLS

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Project Description

The University of Delaware and the New Castle County Vocational Technical School District have initiated a GK-12 partnership in which nine UD graduate students in the sciences are selected annually to serve as Fellows. Fellows are paired with high school science teachers, and these pairs, along with the PIs of this project, form a learning community focused on examining and reflecting on current issues in science education while specifically addressing critical needs in teaching science in vocational technical high schools. Fellow/teacher pairs are introduced to innovative teaching strategies including problem-based learning (PBL) and coteaching and develop activities and assessments that are aligned with state science standards and that support student learning through inquiry. Typically, Delaware GK-12 Fellows have completed qualifying course work and exams and identified research advisers and dissertation topics. With their doctoral research well established, Fellows integrate their research experiences into the classroom in two primary ways: classroom presentations of their research and development of PBL activities related to their research. Fellows prepare five-minute research talks and refine them through multiple rehearsal and feedback sessions in advance of classroom presentation. Fellows thus have numerous opportunities to develop their ability to communicate scientific understandings to an audience with multiple and diverse learning needs. Development of PBL activities in biological and physical sciences provides the Fellows with additional opportunities to relate university research to the high school level, to share their enthusiasm of research, and to demonstrate the relevance of their research to the lives of the students.

<http://www.udel.edu/GK-12/>

Fast Facts about NCCoVOTech District

- Number of Schools: 3
- Student Enrollment: 3,386 (49% female; 99% minority)
- % of Special Education Students: 14.8%
- Student to Computer Ratio: 27:1
- Average Daily Attendance: 95.3% (State = 92.6%)
- Graduation Rate: 96.1% (State = 83%)
- Overall satisfaction rating (parents and students): 4.30 out of 5
- % of parents who would recommend district: 93%
- Employer satisfaction with students: 4.25 out of 5

Career Areas at Howard High School

- Accountancy
- Carpentry
- Computer Network Administration
- Cosmetology
- Culinary Arts
- Dental Assistant
- Electrical Trades
- FSS
- Home Technician
- Public Service

All students at NCCoVOTech take the full academic requirement needed to meet the requirements for a high school diploma.

Students who meet the criteria also earn career program of study certificates.



Incorporating Research into the Classroom

Katie Skalak, Fellow
 Carol Burwell, Teacher
 Integrated Science
 Physical Science

A Medical Mystery

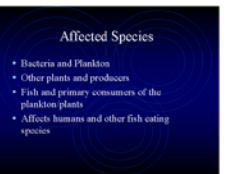
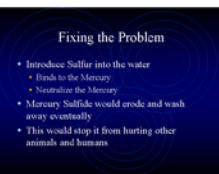
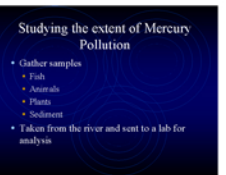
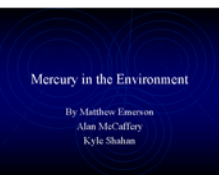
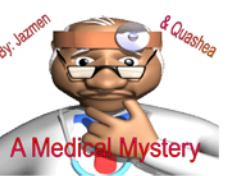
Place yourself in the shoes of a fourth grader. Your teacher is handed a case of a student who is sick. You are to investigate the case. You are to identify the cause of the illness. You are to identify the treatment. You are to identify the prevention. You are to identify the cure.

Transfer tasks: Food webs and Hg cycling

- Scenario: Hg contamination of a recreational water source
- Based on my research
- Various roles for students to select

The project culminated in a "town meeting" in which students engaged in debate to represent their stakeholder's position. After the town meeting, students worked in their groups to create a landscape concept map linking the ideas of bioaccumulation, human impact on the environment, the water cycle, and food webs and energy cycling.

Some Examples of Student Work



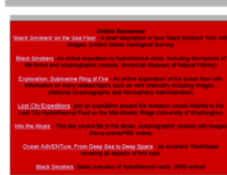
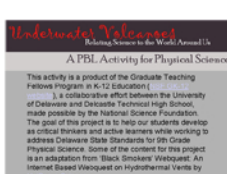
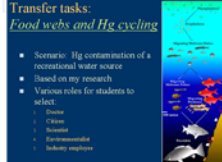
Mercury in the Environment: Part 3

Follow the mercury cycle:

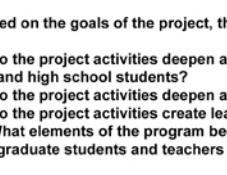
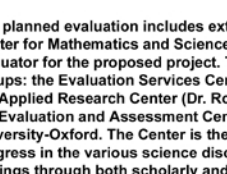
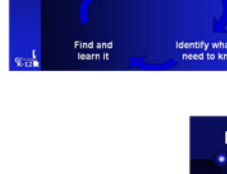
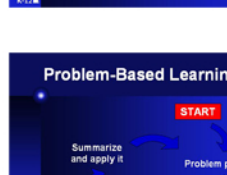
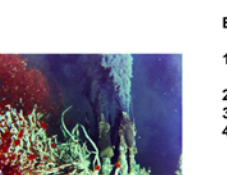
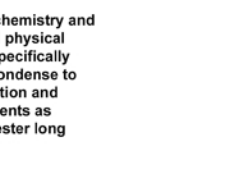
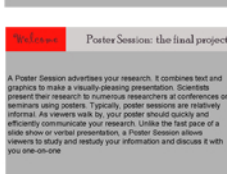
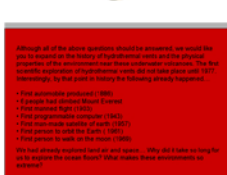
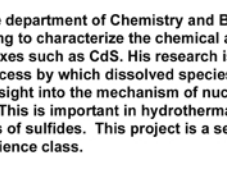
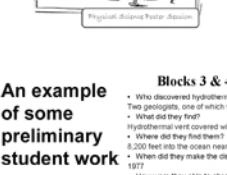
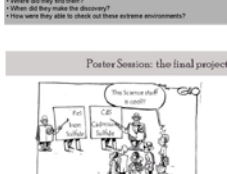
1. Mercury is released into the atmosphere from natural and man-made sources.
2. Mercury is transported by wind and rain to the ground.
3. Mercury is taken up by plants and animals.
4. Mercury is passed on to other organisms through the food chain.
5. Mercury is eventually excreted back into the environment.

Transfer tasks: Food webs and Hg cycling

1. Make sure to create a presentation in a format, which will best describe your presentation topic, your background.
2. Include a WRITTEN SUMMARY on a piece of paper of the following points:
3. Make sure your summary is clearly written.
4. Be sure to list the roles you played in the presentation.
5. Be sure to list the roles you played in the presentation.
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Fellow is a graduate student in the department of Chemistry and Biochemistry and conducts research which is working to characterize the chemical and physical properties of metal sulfide complexes such as CdS. His research is specifically focused on understanding the process by which dissolved species condense to form solid products and to gain insight into the mechanism of nucleation and particle growth of metal sulfides. This is important in hydrothermal vents as they emit particles with high levels of sulfides. This project is a semester long web-based project for Physical Science class.

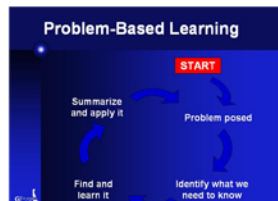


Delaware GK-12 Activities

- In summer workshops, teaching teams will be introduced to a number of innovative teaching strategies, including problem-based learning (PBL).
- During the academic year, Fellows will engage in coteaching with their teacher partners.
- Fellows will gain a better understanding and appreciation of the complexities and nuances of teaching science in high school.
- Teaching teams will have the opportunity to develop PBL activities, aligned with curricular needs, for students to experience the benefits of guided-inquiry learning environments.

What is Coteaching?

- Teaching at the elbow of the other, with multiple teachers
- Focus on learning of ALL students
- Supportive environment for analyzing and critiquing practice
- Opportunity to learn aspects of teaching that are not easily verbalized
- Link between theory and practice



We Will Use PBL to:

- Motivate learning by connecting science course content to real world situations
- Assess content understanding to inform future instruction
- Foster development of reasoning, communication, information retrieval, and team-building skills

Delaware GK-12 Benefits

- Expected outcomes include:
 - Improved communication, teaching, and team building skills for the Fellows,
 - Professional development opportunities for science teachers,
 - Enriched learning for the high school students, and
 - Strengthened partnership between University of Delaware and the New Castle County VoTech School District.

Project Evaluation

The planned evaluation includes external and internal activities. The Evaluation and Assessment Center for Mathematics and Science Education (E & A Center) in Ohio will serve as the external evaluator for the proposed project. The Center brings together the strengths of three evaluation groups: the Evaluation Services Center (Dr. Deborah Zorn, Director) at the University of Cincinnati, the Applied Research Center (Dr. Robert Seuffert, Director) at Miami University—Middletown, and the Evaluation and Assessment Center (Dr. Jane Butler Kahle, Principal Investigator) at Miami University-Oxford. The Center is the repository of valid and reliable instruments to assess progress in the various science disciplines. It is noted for its effective dissemination of research findings through both scholarly and popular venues.

Based on the goals of the project, the evaluation will be guided by the following questions:

1. Do the project activities deepen and extend science content knowledge for fellows, teachers, and high school students?
2. Do the project activities deepen and extend pedagogical knowledge for fellows and teachers?
3. Do the project activities create learning communities?
4. What elements of the program become institutionalized as a program partnering STEM graduate students and teachers to address critical issues in high school science education?

Multiple sources of quantitative and qualitative data will be gathered from fellows, faculty research advisors, cooperating teachers, and high school students. In addition, artifacts, including PBL and Lesson Study units, will be collected and used to address the evaluation questions. The external evaluation will also review reports conducted as part of internal evaluation activities.

