

IMPLEMENTING AN NSF GK-12 PROGRAM: REWARDS AND CHALLENGES

Donna Chamely-Wiik., dchamely@fau.edu, Deborah Louda, dlouda@fau.edu, Jerome Haky, hakyj@fau.edu and Nancy Romance, romance@fau.edu.
Department of Chemistry and Biochemistry, Florida Atlantic University, Boca Raton, FL



Project ChemBOND: The Next Generation

Project Description

- Placement of graduate students in STEM disciplines in local high schools in Palm Beach County
- Collaboration among all project partners (Teachers, Fellows, PI's)
- Implementation of curriculum based materials into the classroom
- Incorporation of research expertise into the high schools
- Development of professional opportunities for graduate fellows and teachers
- Enhancement of high school students' understanding of and attitudes toward science

Project History

- Current GK-12 high school based project as an extension of an NSF funded, university Project ChemBOND
 - Conceptually-based lectures, peer-led group activities and interactive classroom technologies to improve student understanding
- Currently incorporated into the General Chemistry, Organic Chemistry and Biochemistry curriculum at FAU

Goals

Communicating Research in the Classroom

- Bring the research experience of STEM graduate students to a more general audience (e.g. high school students)

Curriculum Based Activities

- Develop, adapt and adopt curriculum-based modules to be used in high schools

Professional Development

- Provide ongoing training and professional development for GK-12 participants (Fellows, Teachers, PI's)

Assessment

- Assess the impact of the presence of the GK-12 fellows upon high school students conceptual understanding of and attitudes towards chemistry and the nature of science

Evaluation

- Evaluate the project's effectiveness in achieving goals

Sustainability

- Build capacity, infrastructure and sustainability to continue collaborations in support of a research focus in high schools

Curriculum-Based Activities

- Development of appropriate materials that enhance high school student understanding of chemistry concepts
- Incorporation of graduate students' research expertise to emphasize the nature of research
- Creation of flexible materials that meet teacher/student needs
- Implementation of materials across different high school curricular levels (Honors, AP and Regular)
- Integration and usage of materials with varying school schedules
- Incorporation of laboratory notebooks for data collection and analyses



Curriculum-Based Modules

Demonstrations, Group Activities and Laboratory Exercises

Activity	Key Concept	Description
Density Demonstration	Scientific Inquiry	Using soda cans to illustrate density differences
Atoms, Isotopes, and Ions Group Activity	Atomic Structure	Using pizza pans and magnets to model atoms
Chromatography Lab	Polarity	Separating ink components by paper chromatography
Chemistry of Household Items	Nomenclature	Using chemicals present in grocery items to utilize principles of nomenclature

Project Assessment

- Graduate Students**
 - Presentations videotaped and evaluated
 - Surveys administered to graduate fellows and high school students
- High School Students**
 - Surveys administered to evaluate student attitudes towards and interest in science
 - Standardized examinations administered to evaluate student performance
- High School Teachers**
 - Surveys administered to evaluate improvements in teaching practices and attitudes towards science

Evaluation



- Utilized the expertise of three evaluators. Their roles included:
 - Assessing the effectiveness of materials developed through this project
 - Assessing the procedures and processes used to accomplish objectives of the project

Rewards

- Improving graduate student presentation and communication skills
- Creating mutual understanding and interactions between the university and the high schools
- Improving high school students' appreciation of scientific research methods
- Developing a substantial portfolio of instructional materials
- Establishing a true learning community between the School District of Palm Beach County and the University

Future Challenges

- Expanding into additional classes such as Environmental Science and Biotechnology
- Incorporating technology into the High Schools
- Improving students reading comprehension capabilities
- Revising materials incorporated into the classrooms
- Enhancing student appreciation of the nature of science and the role of research

Acknowledgements

- This work is supported by:
 - National Science Foundation, through the NSF: GK-12 grant: Award number 0638662
 - Department of Chemistry and Biochemistry at Florida Atlantic University



Multiple Research Initiatives in Classrooms

Vignettes

- Graduate students present 15-minute talks on various aspects of their dissertation research projects
- Research presentation topics include:
 - Overview of their dissertation research
 - Instrumentation used in their research
 - How chemistry plays a role in their current research



Water research mini projects

- Analyze for phosphate, nitrate, iron etc. in local water samples for environmental impact
- Utilize laboratory notebooks for results and analysis to introduce the scientific process

Water research year-long project

- Analyze water samples for seasonal changes throughout the area to assess drought impact
- Collect and analyze original data
- Plan additional experiments

Professional Development

Summer Institute

- Teachers, graduate fellows and PI's participated in a 1-2 week summer institute. Topics included:
 - Inquiry-based, meaningful learning
 - Collaborative evaluation and modification of curriculum-based modules
 - Team building and communication
 - Logistics of incorporating project into the high schools

Graduate Course

- "Special Topics in Chemical Education"
 - Text "How People Learn" by Bransford was the focus of guided discussions.
 - Utilized interdisciplinary research findings from the learning sciences
 - Created framework for designing effective learning environments
 - Discussed methods of scientific inquiry as applied to their experiences in the classroom
 - Discussed logistics of project implementation

Sustainability



- Continue involvement of all participating schools
- Expand into additional schools
- Develop and provide support for implementation
- Compile all instructional materials and distribute to a wider audience
- Continue evaluating and improving the intervention

