IMPLEMENTING AN NSF GK-12 PROGRAM: REWARDS AND CHALLENGES

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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, PIs)
- Implementation of curriculum-based modules 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, PIs)
- Assessment
- Assess the impact of the presence of the GK-12 fellows upon high school students conceptual understanding of and attitudes toward 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 Modules
Demonstrations, Group Activities and Laboratory Exercises

<table>
<thead>
<tr>
<th>Activity</th>
<th>Key Concept</th>
<th>Description</th>
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<tbody>
<tr>
<td>Density Demonstration</td>
<td>Scientific Inquiry</td>
<td>Using soda cans to illustrate density differences</td>
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<tr>
<td>Atoms, Isotopes, and Ions Group Activity</td>
<td>Atomic Structure</td>
<td>Using pomegranate seeds and magnets to model atoms</td>
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<tr>
<td>Chromatography Lab</td>
<td>Polarity</td>
<td>Separating ink components by paper chromatography</td>
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<tr>
<td>Chemistry of Household Things</td>
<td>Nomenclature</td>
<td>Using chemical present or grocery items to utilize principles of nomenclature</td>
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Utilizing the expertise of three evaluators. Their roles included:
- Assessing the effectiveness of materials developed through this project
- Assisting the procedures and processes used to accomplish objectives of the project

Multiple Research Initiatives in Classrooms

Vigilantes
- Graduate students present 15-minute talks on various aspects of their dissertation research projects
- Research presentations 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 drinking water quality
- Utilize laboratory notebooks for results and analysis to introduce the scientific method

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 PIs 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
  - Legitimation of incorporating project into the high schools

Graduate Course
- "Special Topics in Chemical Education"
- "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

Future Challenges

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

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

Acknowledgements

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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