Arkansas State University graduate students enhance communication skills and science education in the Arkansas Delta

JL Bouldin1, KL Yanowitz2, CA Miller3, AA Grippo3, JF Kennon4

1Dept of Biological Sciences, 2Environmental Sciences Program, 3Dept of Psychology & Counseling, 4Delta Institute for Mathematics & Science Education, 5Molecular Biosciences Program, 6Dept of Chemistry & Physics

ABSTRACT

Interest in science careers begins during the early years of a child's education. Enhanced science curriculum in grades 6-8 in six area public schools is facilitated by the NSF-funded GK12 Program at ASU. The participating rural public schools in the Arkansas Delta region which are represented by ethnically diverse populations. The first two years of our program, 2,381 rural public school students have been exposed to enhanced science learning. Graduate Fellows team-teach one day per week with their two Mentor Teachers to enhance the science environment and strengthen Mentor Teachers' content knowledge and experience. Hands-on learning for the students is directed by the Graduate Fellows based on their research experiences. Lesson plans written by the Fellows are aligned to the Arkansas Science Curriculum Frameworks, and spark excitement and enlighten the students. Increased understanding of their research and improved communication skills are obtained by the Graduate Fellows while middle school students are introduced to cutting-edge science curriculum. Lesson plans are available to classroom teachers for further use and facilitate continued enhanced science curriculum to encourage student interest in STEM careers.

INTRODUCTION

The NSF-funded GK12 Program at ASU is in the 3rd year of a 5 year continuing grant. NSF currently has 142 active GK12 programs nationwide. Graduate Fellows are placed into area rural school districts with ethnically diverse students (Table 1) to enhance science curriculum to these students.

NSF Program goals are as follows:
1) Improved communication, leadership and team building for the Fellow
2) Enhanced teaching and learning experiences for school children
ASU Program Goals are as follows:
1) Improve Fellows' communication to a broad audience to create a deeper understanding of science
2) Enhance teachers' experience
3) Increase student interest in STEM careers through exposure to enriched STEM environment
4) Strengthen ASU & rural school districts' partnerships

Graduate students are matched to school districts (Mentor Teachers) based on personality traits and team building exercises. Graduate Fellows and Mentor Teachers are on a 1:2 ratio to increase exposure of rural middle school students to cutting-edge science activities.

Train for Fellows includes:
- Summer workshop to introduce 6E lesson plans and pedagogy skills
- Inquiry-based lesson plan development with Mentor Teachers
- 1) engage 2) explore 3) explain 4) elaborate 5) extend evaluate
- Fall & Spring workshops with Mentor Teachers with lesson plan development
- Reflect on improvements as Fellow becomes familiar with classroom
- Year-end reflection to improve team building and program evaluation
- Evaluate first semester and discuss improvements for remainder of year

End of year evaluation to reflect success & build for following year
- Evaluate academic year and discuss student assessment

METHODS

The project evaluator assesses the Fellows, Mentor Teachers, and students to measure the success and offer recommendations for the continued success of the GK12 Program. The recommendations are continually addressed during the academic year. Public school administrators are invited to select workshops and also evaluated to measure Program support in their local school.

Fellows are evaluated for their preparedness to teach, perception of their contributions to the classroom, and their classroom activities.

Teachers are evaluated for their perception of the Fellow's classroom contribution, student classroom response to Fellow, and increased interest in science as a result of the program.

Students are evaluated for their confidence in science careers and interest in science careers, plans to continue in science-related education, and communication with parents/friends about classroom activities with the Fellow.

Evaluation statistical treatments:
Evaluations were based on a Likert-scale ranging from 5 (strongly agree) to 1 (strongly disagree). Pre/post measures were compared with paired t-test; single sample t-tests were evaluated with a one sample t-test comparing means to a value of 3 (neutral point of scale).

RESULTS

• Fellows evaluations revealed a significant increase in confidence in classroom teaching and pedagogy (Table 2) and Mentor Teachers were confident that science curriculum was enhanced (Table 3).

• Students' surveys noted a greater interest in science and the curriculum taught when Fellows were in classroom (Table 4).

• Increased discussion with parents and friends also reflect greater interest in the subject and possible continuation in science.

• Fellows indicated on each survey an increase communication skill, speaking confidence, and excitement for research.

• Mentor Teachers perspectives include the following comments:

  “Good model mentor, opens up their eyes to new possibilities.”

  “My students are excited and engaged when the Fellow comes to my classroom....they are not hesitant to ask questions.”

  “Our Fellow made science fun and interesting. He makes the students want to learn.”

DISCUSSION

• Graduate Fellows are fulfilling the NSF’s goals of an enriched graduate experience and enhanced communication skills.

• Fellows are learning pedagogy skills they take with them when entering the workforce.

• Rural middle school students in the Arkansas Delta are becoming more excited about the sciences with GK12 Fellows in the classrooms.

• Arkansas State University is connecting with area public schools as teachers, parents, and students visit the University and are exposed to graduate research through the schools.

• Mentor Teachers are experiencing new lesson plans included in the state science curriculum through their GK12 Fellow

• Peer-reviewed lesson plans taught by the Fellows are available to the Mentor Teachers on the GK12 website (http://www2.astate.edu/gk12).

• Fellows and Mentor Teachers work as a team to encourage experience-based learning in the science curriculum.

Table 2: Quantitative rating of Mentor/Teacher survey triangulated with open-ended responses to fellow’s classroom activity. Likert scale = 1-5; higher score = higher agreement with statement.

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean (SD)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>My students learn more interest in science this year</td>
<td>4.6 (0.8)</td>
<td>0.01</td>
</tr>
<tr>
<td>My students learn more interest in science the yaks are part of the syllabus</td>
<td>4.5 (0.8)</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Table 3: Results of student surveys to determine increased interest in science with GK12 Fellow in classroom. Likert scale = 1-5; higher score = higher agreement with statement.

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean (SD)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having the resident scientist come to class helped me to learn the material better</td>
<td>4.4 (1.1)</td>
<td>0.04</td>
</tr>
<tr>
<td>Having the resident scientist come to class made me more interested in getting more education in science after high school</td>
<td>4.4 (1.1)</td>
<td>0.05</td>
</tr>
<tr>
<td>Having the resident scientist come to class made me more interested in science</td>
<td>4.6 (1.1)</td>
<td>0.01</td>
</tr>
<tr>
<td>Learning the resident scientist came to class made the science more interesting</td>
<td>4.6 (1.1)</td>
<td>0.01</td>
</tr>
<tr>
<td>Having the resident scientist came to class made the subject more fun</td>
<td>4.4 (1.1)</td>
<td>0.02</td>
</tr>
<tr>
<td>Talked to my parents/guardians about the things we did in class</td>
<td>3.2 (1.1)</td>
<td>0.09</td>
</tr>
<tr>
<td>Talked to my friends about the things we did in class when the resident scientist came to my class</td>
<td>4.9 (1.1)</td>
<td>0.01</td>
</tr>
</tbody>
</table>

ACKNOWLEDGMENTS

This project is made possible by a NSF grant DGE-0961977. The investigators would like to thank the participating Mentor Teachers and Graduate Fellows. Special thanks to the school administrators for their assistance in the education of the children in the Arkansas Delta and enhancing their learning in science curriculum by participating in this project.