AN APPROACH FOR DISCOVERING AND INSPIRING FUTURE GEOSCIENTISTS IN URBAN SETTINGS AND BEYOND

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Outline

- Science, Technology, Engineering and Mathematics (STEM) Workforce
- Trends in Geosciences Workforce
- Projected Demographics of United States
- Overview of Project GAP (Geoscience Awareness Program)
- Project GAP Intervention Model
- Results
- Conclusion and Acknowledgements
Science, Technology, Engineering and Mathematics (STEM) Workforce
Trends in Students’ Aspiration to Major in a STEM Discipline by Racial Identification, 1971-2009

Reference: January 2010 Research Brief---Higher Education Research Institute at UCLA home of the Cooperative Institutional Research Program
Percentage of 2004 STEM Aspirants who completed STEM Degrees in Four and Five Years, by Race/Ethnicity

Reference: January 2010 Research Brief---Higher Education Research Institute at UCLA home of the Cooperative Institutional Research Program
Four- and Five-Year Degree Completion Rates of 2004 Freshmen, by Initial Major Aspiration and Race/Ethnicity

Reference: January 2010 Research Brief---Higher Education Research Institute at UCLA home of the Cooperative Institutional Research Program
Trends in Science Degree Awarded

Data compiled from NSF/SRS

Bachelors
Trends in Geosciences Workforce

- Bachelors

Data compiled from NSF/SRS
Overview of Project GAP
(Geoscience Awareness Program)
Project GAP

Develop urban underrepresented minority (URM) students’ interest in majoring in geosciences through College and Pre-college Initiatives

Approaches:

• Identify targeted audience and partnership institutions

• Develop series of lectures, presentations, brochures and educational materials about Geosciences

• Aggressively recruit URBAN URM students into Ohio State University, School of Earth Sciences programs

• Develop working relations with HBCU, NABGG, SACNAS and other Minority Scientific Organizations
Project GAP Interventions Model: Pre-college Initiatives

- Pre-survey
- Presentation
- Hands-on activities
- Post-survey
- Brochure
### TABLE I: Survey questions administered before and after Project GAP.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I think geological science is really interesting.</td>
<td></td>
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<td></td>
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<tr>
<td>2. Geoscientists or Earth scientists are mostly men who work in the field.</td>
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<td>3. I might want to be a geoscientist or Earth scientist.</td>
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<td>4. I am familiar with what a geoscientist or Earth scientist does.</td>
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<td>5. I know a geoscientist or Earth scientist personally.</td>
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<tr>
<td>6. You need to know a lot of math to become a geoscientist or Earth scientist.</td>
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<tr>
<td>7. Women can be geoscientists or Earth scientists.</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>8. Geoscientists or Earth scientists cannot be trusted.</td>
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<td></td>
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<tr>
<td>9. Geoscientists or Earth scientists cannot be religious.</td>
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<tr>
<td>10. My family would be proud of me if I became a geoscientist or Earth scientist.</td>
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</tbody>
</table>

Outline of Pre-college Initiative Presentation

- Selected and targeted questions
- Definition of Geosciences (connection to the outdoors)
- Earth Composition and Structure
- What do Geoscientists Do?
- Who are Geoscientists?
- Where do Geoscientists work?
- Prospective Employers
- Salary Outlook for Geoscientists
- Relevance of Geosciences to Society
- Presenting hands-on activities
Targeted Questions

- Do you want to know why earthquakes happen?
- Are you interested in traveling around the world and exploring the oceans?
- Do you want to protect our environment?
- Do you want to learn about global warming and climate change?
- Are you interested in contributing to solving our energy problem?
- Do you want to contribute to the development of new technologies?
- Do you want to make a difference in society?
- Are you interested in finding clean water for all global citizens?
- Are you interested in learning about our Earth?
- Are you interested in understanding the origin of volcanic activities?
What Do Geoscientists Do?

**Disclose**
Information about the earth’s geologic past and present by applying sophisticated instruments to analyze the composition of earth, rock, water and fossils.

[Ammonite](http://en.wikipedia.org/wiki/Fossil)

**Travel**
To remote and beautiful places around the globe.

[St. Thomas in the U.S. Virgin Islands](http://en.wikipedia.org/wiki/Fossil)

[Bora Bora in Tahiti](http://en.wikipedia.org/wiki/Fossil)
Who Are Geoscientists?

They are hardworking men and women from diverse background and diverse experiences.

Lisa White  
Dina L. Lopez  
Anne Carey  
Estella Atekwana  
Aaron Velasco  
Samuel Mukasa  
John T. Leftwich
Where Do Geoscientists Work?

In the field

They work in the Lab

They work in the office
Relevance of Geosciences to Society

- Natural Disasters and Occurrence
- Energy
- Climate Change
## Salary Outlook

### 2008-09 Average Salary By Degree

<table>
<thead>
<tr>
<th>YEARS EXPER</th>
<th>B.S.</th>
<th>M.S.</th>
<th>Ph.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2</td>
<td>$73,000</td>
<td>$88,800</td>
<td>$95,000</td>
</tr>
<tr>
<td>3-5</td>
<td>88,300</td>
<td>112,000</td>
<td>147,000</td>
</tr>
<tr>
<td>6-9</td>
<td>90,000</td>
<td>141,400</td>
<td>105,000</td>
</tr>
<tr>
<td>10-14</td>
<td>102,500</td>
<td>122,900</td>
<td>155,000</td>
</tr>
<tr>
<td>15-19</td>
<td>124,300</td>
<td>166,500</td>
<td>134,900</td>
</tr>
<tr>
<td>20-24</td>
<td>147,500</td>
<td>172,300</td>
<td>215,000</td>
</tr>
<tr>
<td>25+</td>
<td>162,300</td>
<td>179,000</td>
<td>150,000</td>
</tr>
</tbody>
</table>

What Do You Need

- Stay in school
- Take your Math and Sciences class seriously. Especially your Chemistry, Biology, Physics and Math classes
- Social Sciences (English, History and Geography)
- Good communication skills
Hands on Activities

- Topographic Maps
- Unknown Surface
- Glacier Dynamics
Evaluation Methods

- 71 students completed both the pre-participation and post-participation surveys.
- Agreement was treated as if it were a continuous variable.
- Responses were coded as follows:
  Strongly agree(4), agree(3), undecided(2.5), disagree(2), and strongly disagree(1).
- Mean response scores were calculated for each pre-participation and post-participation questions for the 71 students.
- Within-student change scores were calculated.
- The significance of the change score was determined with two-tailed dependent t-test.
- Complete statistical data is given below.
Results and Discussions

Highlights

- Data from Question 1 (Q1) shows that the interest of the students in the geosciences increased after they participated in Project GAP.

- Data from Q2 shows that after participation students were more likely to disagree with the statement "Geologists or Earth scientists are mostly men who work in the field.”

The 71 URM students’ average responses to the attitude survey questions.
Results and Discussions

Highlights

Data from Q3 shows students were more likely to agree with the statement “I might want to be a geoscientist or Earth scientist” after participation ($p < .0001$).

Their average response increased from a level indicating disagree (1.98) to a level that, on average, was nearly neutral (2.46).

The 71 URM students’ average responses to the attitude survey questions:

1. I think Geoscience is really interesting
   - Pre: 2.63
   - Post: 2.96*

2. Geoscientists are mostly males
   - Pre: 1.95**
   - Post: 2.34

3. I might want to be a geoscientist
   - Pre: 1.98
   - Post: 2.46***

4. I am familiar with what a geoscientist does
   - Pre: 2.70
   - Post: 2.94

5. I know a geoscientist personally
   - Pre: 1.73
   - Post: 2.02*

6. You need to know a lot of math to be a geoscientist
   - Pre: 3.04
   - Post: 3.09

7. Women can be geoscientists
   - Pre: 3.57
   - Post: 3.69

8. Geoscientists cannot be trusted
   - Pre: 1.79
   - Post: 1.59

9. Geoscientists cannot be religious
   - Pre: 1.81
   - Post: 1.67

10. My family would be proud if I were a geoscientist
    - Pre: 3.18
    - Post: 3.30

(1=Strongly disagree; 2=Disagree; 2.5=Undecided; 3=Agree; 4=Strongly agree)

* $p < .05$; ** $p < .005$; *** $p < .0001$
Results and Discussions

Highlights

“I might want to be a geoscientist”

<table>
<thead>
<tr>
<th>Pre-participation</th>
<th>Post-participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly disagree</td>
<td>Strongly disagree</td>
</tr>
<tr>
<td>19 students</td>
<td>8 students</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pre-participation</th>
<th>Pre-participation</th>
<th>Post-participation</th>
<th>Post-participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>Agree</td>
<td>Strongly agree</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>1 student</td>
<td>1 student</td>
<td>21 students</td>
<td>4 students</td>
</tr>
</tbody>
</table>

The data strongly suggests that there is an increase in the desire to become a geologist after participation in Project GAP’s intervention.
Conclusion

- Analyses of pre and postparticipation survey responses indicated statistically significant increases in students’ attitudes toward and interest in geosciences.

- With any kind of self-reported survey data, questions can be raised about possible source of bias.

- We think it is unlikely that students provided responses that they felt we wanted to hear: If this were the case, one would expect to find significant improvement in all of the attitudes that were assessed, rather than in only 4 of the 10 attitudes being measured.

- We believe these statistically significant results are a reflection of true changes in participants’ attitudes and beliefs.

- We thus interpret the intervention model developed through Project GAP as being effective and potentially transportable to other underrepresented minority student populations.
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Dr. Carol Landis (The Ohio State University)
Dr. Woldai Ghebreab (formerly at CSCC)

Former Student Assistant:
Nicholas Vallera