Broadening Middle-School Students’ Images of Science and Scientists

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Student Stereotypes

“...a man who wears a white coat and works in a laboratory...is elderly or middle aged and wears glasses...wears a beard...is surrounded by equipment...[and] spends his days doing experiments”

*Mead and Mertraux, 1957*
Student Stereotypes

Students respect scientists...

... but they don’t see themselves as scientists

• Why?
  – Career choices
  – Public opinion on science policy

• Solution?
  – Scientists in K-12 schools!
Project Fulcrum

• NSF GK-12 Program
  – 4th year
  – Grades 3-8
  – Lead teachers team with a math, science or engineering graduate-student scientist
  – Scientist in one school for the entire year

• Prior research: scientists in schools
  – Highly dependent on specific scientist
  – Changing image vs. broadening image

Student Attitudes Project

A quarter-long project designed to broaden student attitudes about science and scientists

• Teachers
  – Research attitudes of their specific students
  – Design a project to meet those needs
  – Evaluate
  – Document and disseminate

• Graduate student-scientists
  – Identify resources
  – Help execute project
Pre-Project Research

• Important!
  – Teachers and scientists often could predict student answers
  – but were surprised at reasons for those answers

• No templates
  – Projects based on teacher research & student feedback
  – Caused some anxiety
Pre-Project Research

- Image of Science and Scientists Survey
- Teacher-generated open-ended questions
  - Where do people do science?
  - Name different types of scientists
  - What are important characteristics for scientists to have?
  - Would you want to be a scientist? Why or why not?
Types of Projects

Although projects were specialized to each situation, they fell into three general categories

- Scientists
- People who use science, but may not be ‘scientists’
- Developing science skills
Scientists

• Scientist visits
  – Ability for students to ask questions
  – Have students guess what type of scientist
  – Have students identify which visitors are scientists

• Research on scientists
  – Different fields of science, ethnicities, genders, time periods and countries

• Combined research and visits
  – Research allows students to prepare questions for visiting scientists
People Who Use Science

• Role models and science
  – How does a role model in your life use science or math?
  – Research a scientist and make a Venn diagram comparing how the scientist is similar to your role model.

• What jobs do NOT use science?
  – List jobs that use science and jobs that don’t
  – Share with the class and come to a consensus
  – Are there jobs that don’t use science (or math?)
Science Skills

• Developing student questioning skills
  – Role of questions in the scientific method
  – What makes a good question?
  – Develop questions to ask visiting scientists
  – Visiting scientists discuss questions in their fields, including their own research questions

• Problem solving in science
  – Role of problem solving in science
  – How do you problem solve in your everyday life?
  – Ask visiting scientists how they use problem solving in their jobs and their lives.
Formative Assessment

• Discussed at some group meetings

• Modified projects
  – Student feedback: Am I meeting my goals?
  – Colleague feedback: Can I adapt other good ideas to my needs?

• Support from project organizers
  – Changing your project is OK
  – Don’t compare your project to others’ projects
  – Don’t assume you know what your students are thinking – ask.
Impact on Students

• Hard to assess specific impact of project

• Anecdotal evidence from teachers
  – Broader vision of what scientists do, where they work and necessary skills
  – Significant improvements in some individual students’ attitudes toward science/scientists
  – Presence of GK-12 scientist on a regular basis has largest impact

• Image of Science and Scientists Survey
  – Highly gender dependent
  – Very school specific
Impact on Teachers

• Majority felt project worthwhile doing
  – “I wouldn’t necessarily do an entire project on my own if I weren’t part of Project Fulcrum, but now I know where in the curriculum I can emphasize these issues”.

• Major challenge: balancing ‘nature of science’ vs. content knowledge on standardized tests, pacing charts, etc.
Impact on Teachers

• Emphasis on research showing up elsewhere
  – More efforts to find out what students know before planning lessons and projects.
  – Formative and summative assessment
  – Teachers realize flexibility is necessary (and good)

• Evolution in goals of repeat teachers
Impact on Scientists

• Ideal project for involving scientists
  – Minimal time commitment, but some preparation is necessary
    • What are the goals of the project
    • How long should you be there?
    • What do you need to bring or be prepared to do?
  – Supported teachers’ goals

• Are scientists ready to be ‘Role Models’?
  – Selling science vs. painting a realistic picture
  – Questions – some are very personal and highly gendered
Impact on Scientists

• Lots of surprises
  – Firm stereotypes at lower grades
  – ‘Scientists don’t like music’
  – ‘Scientists don’t dance’
  – ‘Scientists don’t even watch TV’
  – ‘All scientists like Star Trek’
  – ‘Scientists can’t have families because they don’t make enough money to support them’

• Surprised by impact of movies and TV

• Re-emphasized to scientists why it is important for them to be there and what role they can play
Suggestions

• Teachers should determine
  – Timing, duration, type of project, goal, relationship to curriculum…

• Research before, during and after
  – Don’t start planning until you determine needs
  – Adapt as necessary

• Support
  – Teachers should share ideas, but not compare projects
  – Avoid templates
  – Expertise