Encouraging Girls – The Societal Benefits of Physical Science

POPS! – The Power of Physical Science (MSP- Start)

A work in progress…

The POPS! Definition of Student Success

A successful science student is motivated to explore, confident in her abilities, and proficient in science, with a deep understanding of the physical universe.

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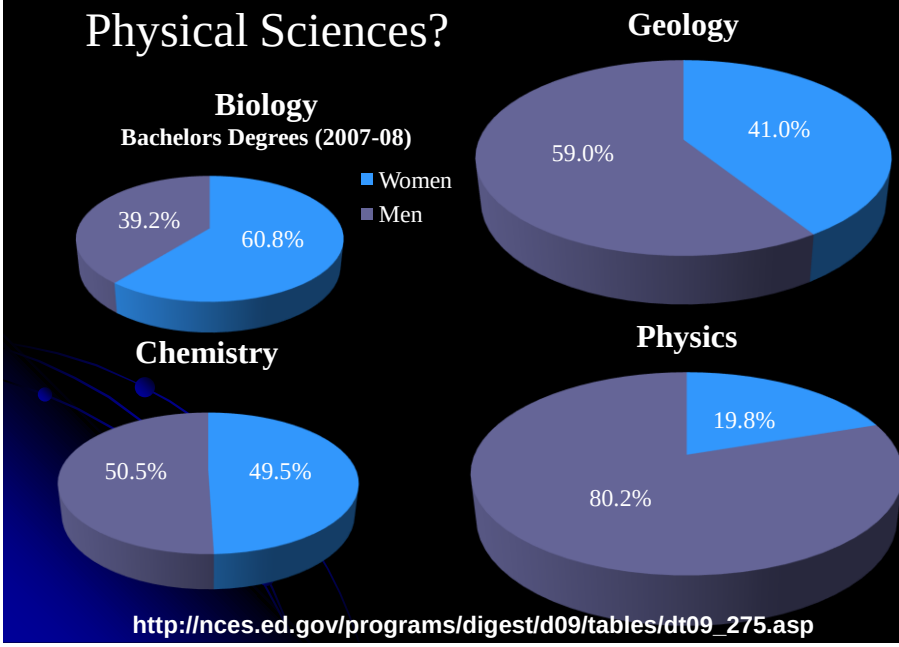
Why Do Fewer Girls than Boys Study the Physical Sciences?



http://nces.ed.gov/programs/digest/d09/tables/dt09_275.asp

Discussion Question:

What are some possible reasons for this disparity between the biological and physical sciences?

Why Does this Matter?

NSF Strategic Plan includes Broadening Participation
http://www.nsf.gov/od/broadeningparticipation/bp.jsp

Our Disciplines cannot afford to miss half the population

POPS! – The Power of Physical Science (MSP- Start)

Steps:

- Study the Research Literature
- Consult with Teachers
- Develop Pilot Study Curriculum
  - Evidence-based
  - Hands-On
- Pilot Study
- Expand Based on Results

•Study the Research Literature

Where is the Best Place to Start?

- In an AIP Survey of women physicists , 60% indicated that they first thought of studying physics while in high school; only 17% while in college (Ivie, R., & Guo, S., 2001).
- Middle school years - gender differences in achievement and attitudes typically widen (Jones, M., Howe, A., & Rua, M., 2000).
- Engaging students in inquiry-oriented science investigations during middle school will provide mastery experiences necessary to the development of strong science self-efficacy beliefs (Britner, S., & Pajares, F., 2006).

•Study the Research Literature

Mastery Experiences

- Among 319 5th-8th grade boys and girls, boys reported a higher number of mastery experiences in science than girls.
- Mastery experiences significantly predicted science self-efficacy for both 5th-8th grade boys and girls (Britner, S., & Pajares, F., 2006).

Interest &Self-Efficacy

- Among 4th-7th grade students, more boys than girls indicated an interest in taking science courses the next school year (Farenga, S. J., & Joyce, B. A., 1999).
- A sample of 40 girls in grades 2, 5, 8, and 11 reported a preference for problem solving and hands-on activities during science class (Baker, D., & Leary, R., 1995).
- Among 319 5th-8th grade boys and girls, science self-efficacy and science self-concept was the most consistent predictor of girls' science grades (Britner, S., & Pajares, F., 2006).

•Study the Research Literature

Importance of "Helping Others"

•Among sixth graders, more females than males list "help other people" and "work with people instead of things" as an important characteristic of a future job (Jones, M., Howe, A., & Rua, M., 2000).

•Of a sample of 40 girls in grades 2, 5, 8, and 11, girls rejected future careers in physical science because they did not see physical science as helping or caring (Baker, D., & Leary, R., 1995).

Discussion Question:

Group work is often encouraged in the sciences. Research suggests that the size and composition of student groups impacts girls differently than boys. What "best practices" can we communicate to teachers about this question?

•Study the Research Literature

Group Work and Gender

•Both male and female fifth- and sixth- grade students report higher self-ratings of confidence in small groups rather than whole-class activities (Meece, J., & Jones, M., 1996).

•The majority of girls' collaboration-in-action talk (related to the task at hand) in small groups (4-6 students) occurs when there is an equal number of boys and girls or when the girls outnumber the boys (Holden, C., 1993).

•Consult with Teachers

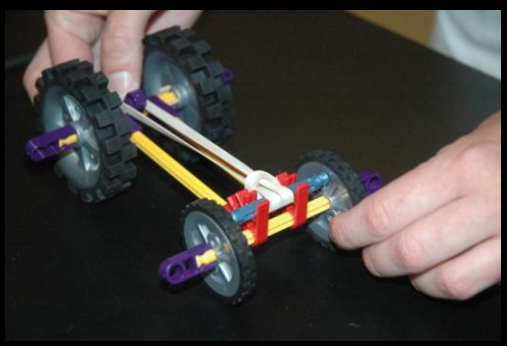
•Series of workshops on campus with Teacher Partners

•Context – NYS Science Standards and 8th Grade Test
- District-specific curriculum 5th – 8th grades

•Important features for Teachers:
- •Strong connection to NYS Science Standards
- •Time Constraints
- •Ease of Use

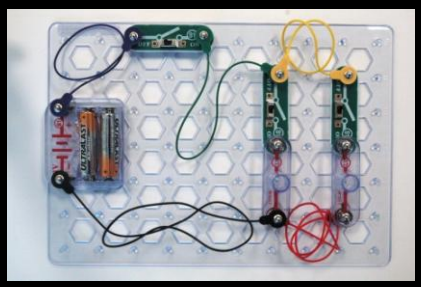
•Develop Pilot Study Curriculum

Lesson	Hands On	Societal Benefits
Pre-assessment		
KE & PE	K'Nex Car	Safety in Cars



•Develop Pilot Study Curriculum

Lesson	Hands On	Societal Benefits
Pre-assessment		
KE & PE	K'Nex Car	Safety in Cars
Electricity	Circuits	Medical Devices



•Develop Pilot Study Curriculum

Lesson	Hands On	Societal Benefits
Pre-assessment		
KE & PE	K'Nex Car	Safety in Cars
Electricity	Circuits	Medical Devices
Generators	POPS Generator	

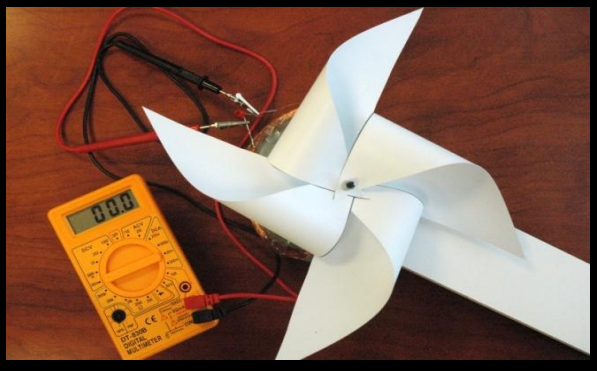
Example

•Develop Pilot Study Curriculum

Lesson	Hands On	Societal Benefits
Pre-assessment		
KE & PE	K'Nex Car	Safety in Cars
Electricity	Circuits	Medical Devices
Generators	POPS Generator	Bangladesh
The Sun	Energy Cards	GYS Team Burma

•Develop Pilot Study Curriculum

Lesson	Hands On	Societal Benefits
Pre-assessment		
KE & PE		
Electricity		
Generators		
The Sun		
Energy Transfer	Windmills	Transfer



•Develop Pilot Study Curriculum

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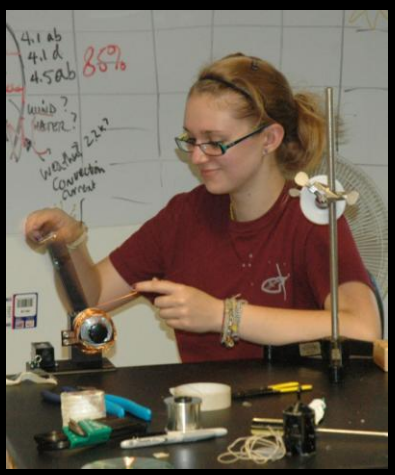
Post -assessment		

•Develop Pilot Study Curriculum

Each Lesson Includes…

- •Teacher Notes
- •Powerpoint Presentations
- •Student Notes Sheets
- •Homework Assignments
- •Hands-On Materials
- •Societal Benefits Videos

Example



Discussion Question:

How can college and university faculty help K-12 teachers articulate the relevance of science to their students?

•Pilot Study

Beginning next week!

Treatment Group

– 5th , 6th, and 8th graders at four school districts

- Approximately 250 students

Control Group

– 5th and 6th graders at two school districts

- Approximately 140 students

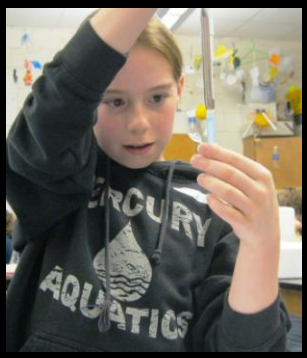
•Pilot Study

Pre- and Post- Attitudes Survey

- Science interest, science efficacy, attitudes about societal benefits of science

Pre- and Post- Content Exam

- Questions based on past NYS Intermediate Science Exam
- Teacher-designed



•Expand Based on Results

Future Directions for POPS!

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Motivation – Science Helps Others

Confidence – Hands-on activities encourage self-efficacy

Proficiency – Alignment to NYS Standards

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