



Using Student Research in Your Classroom

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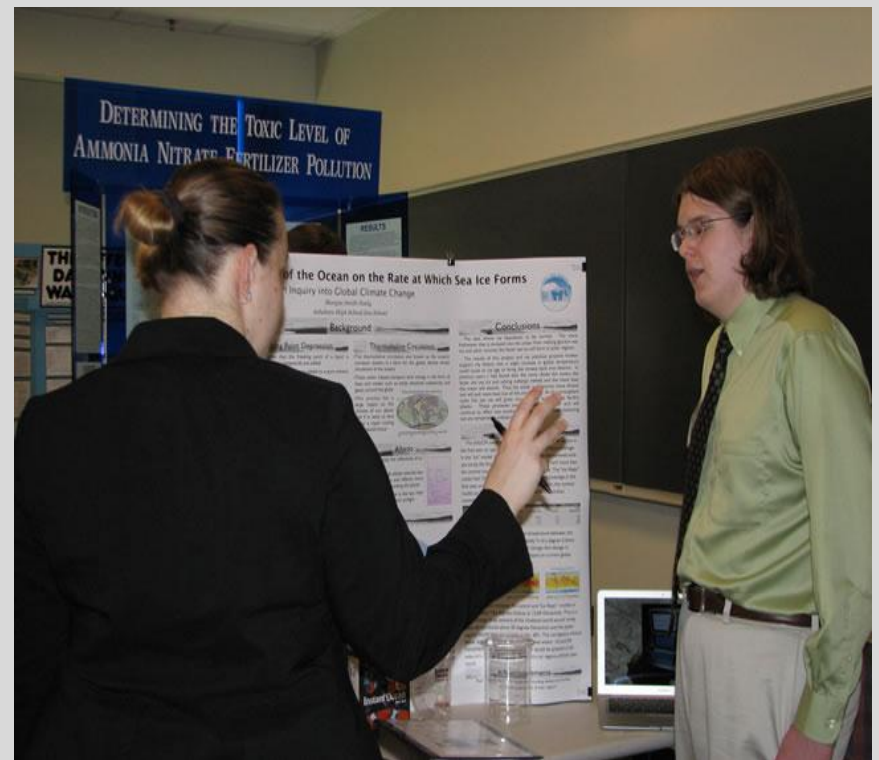
www.ncsciencefair.org

NCSEF



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Science & Engineering Fair

What do you think of when you think of a Science Fair?

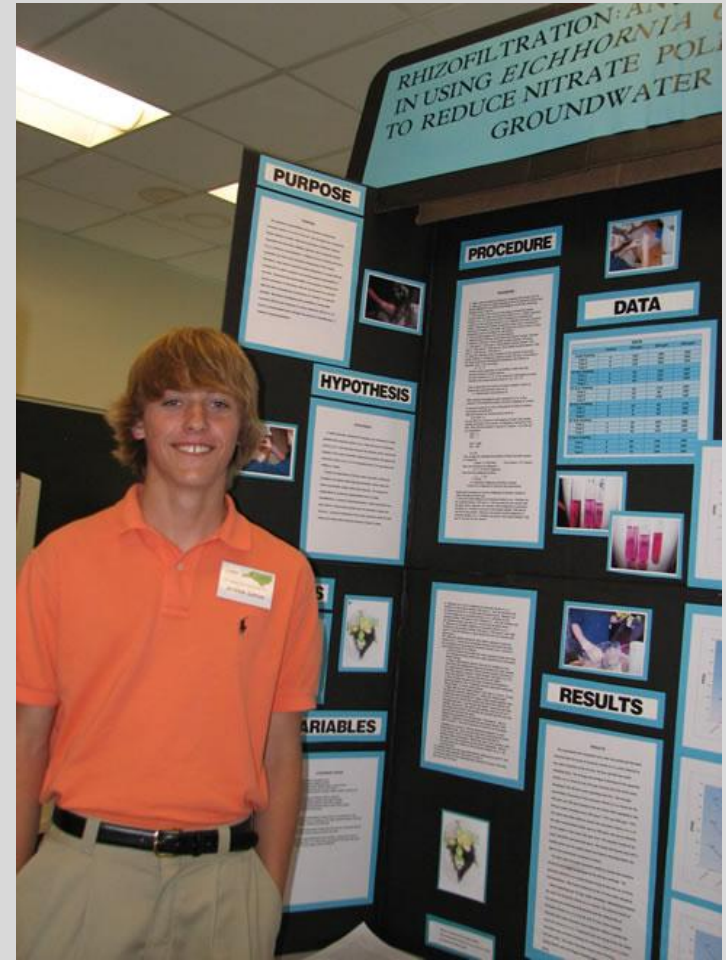
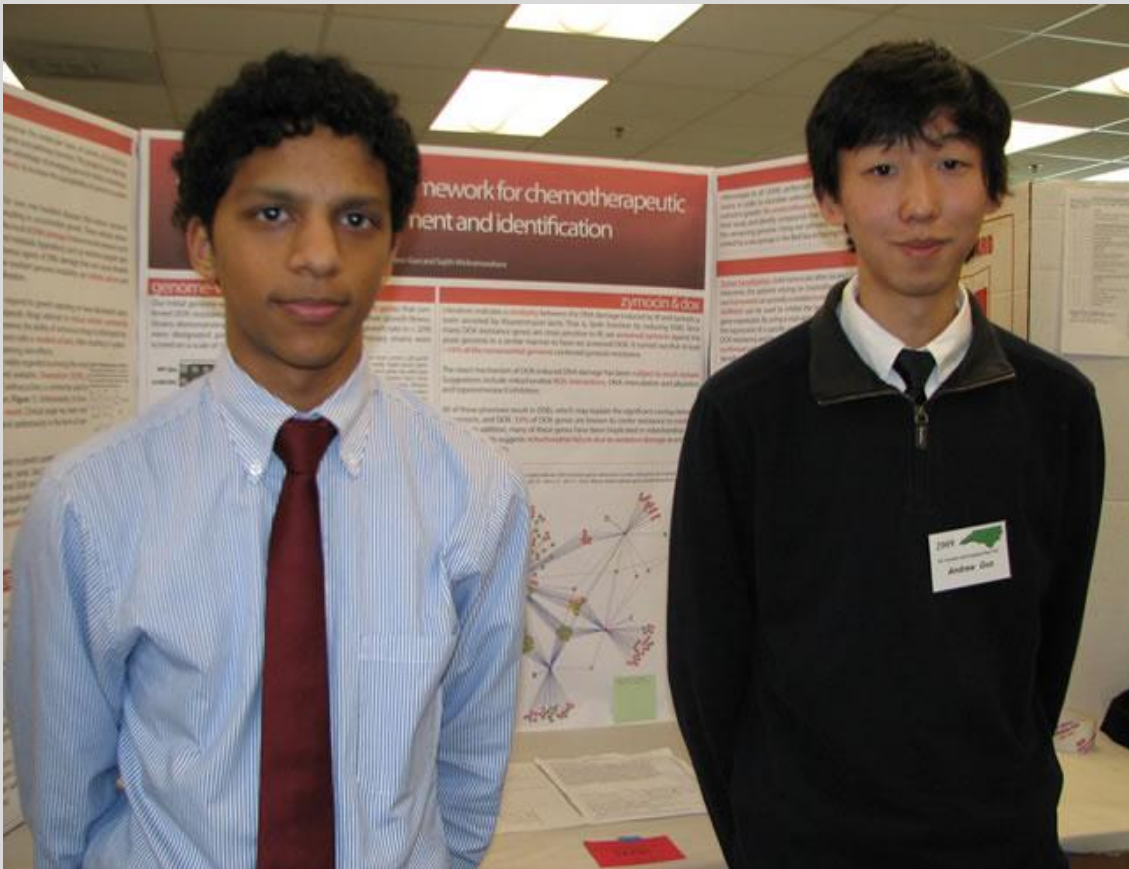


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Real Problems



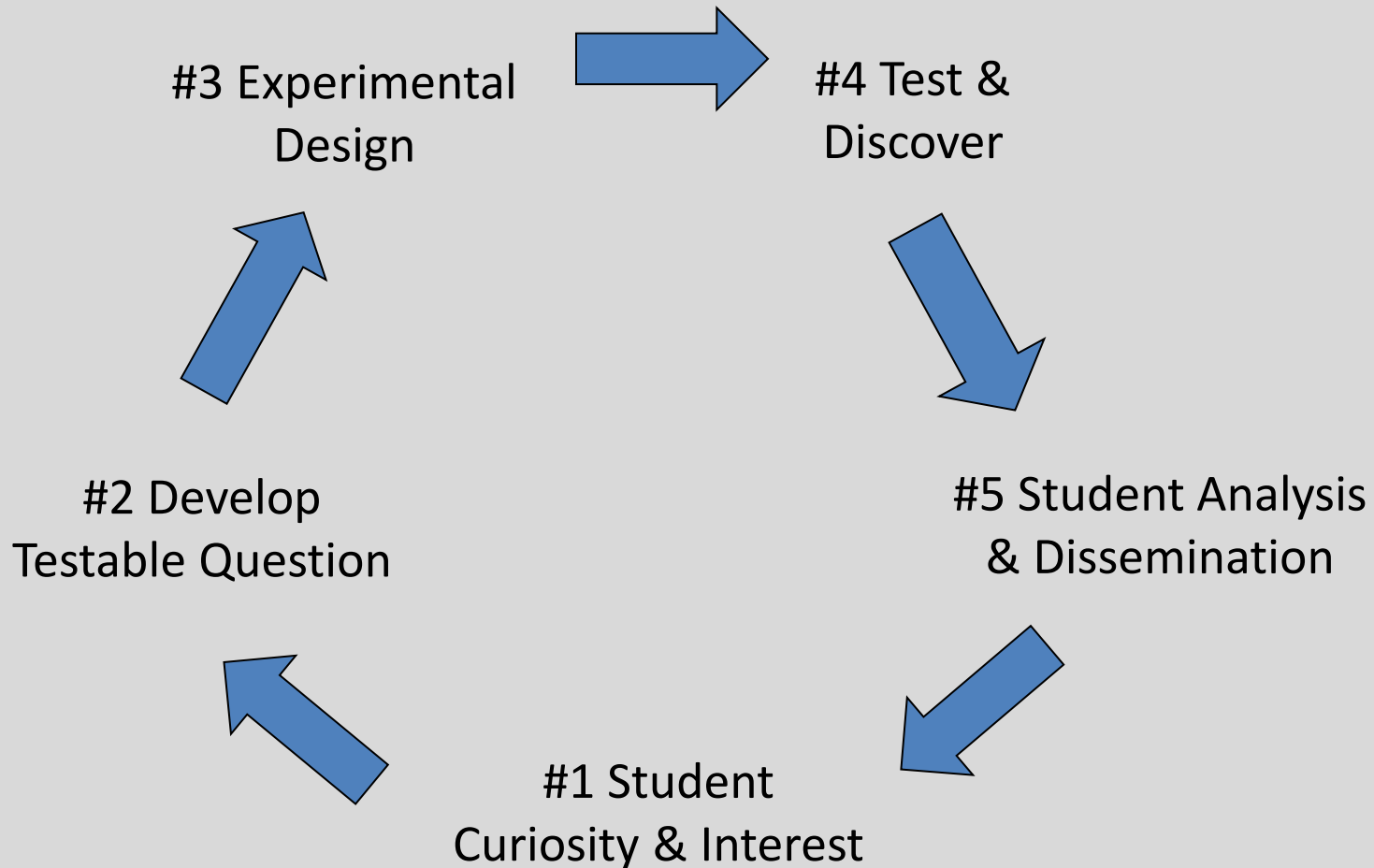
New Solutions



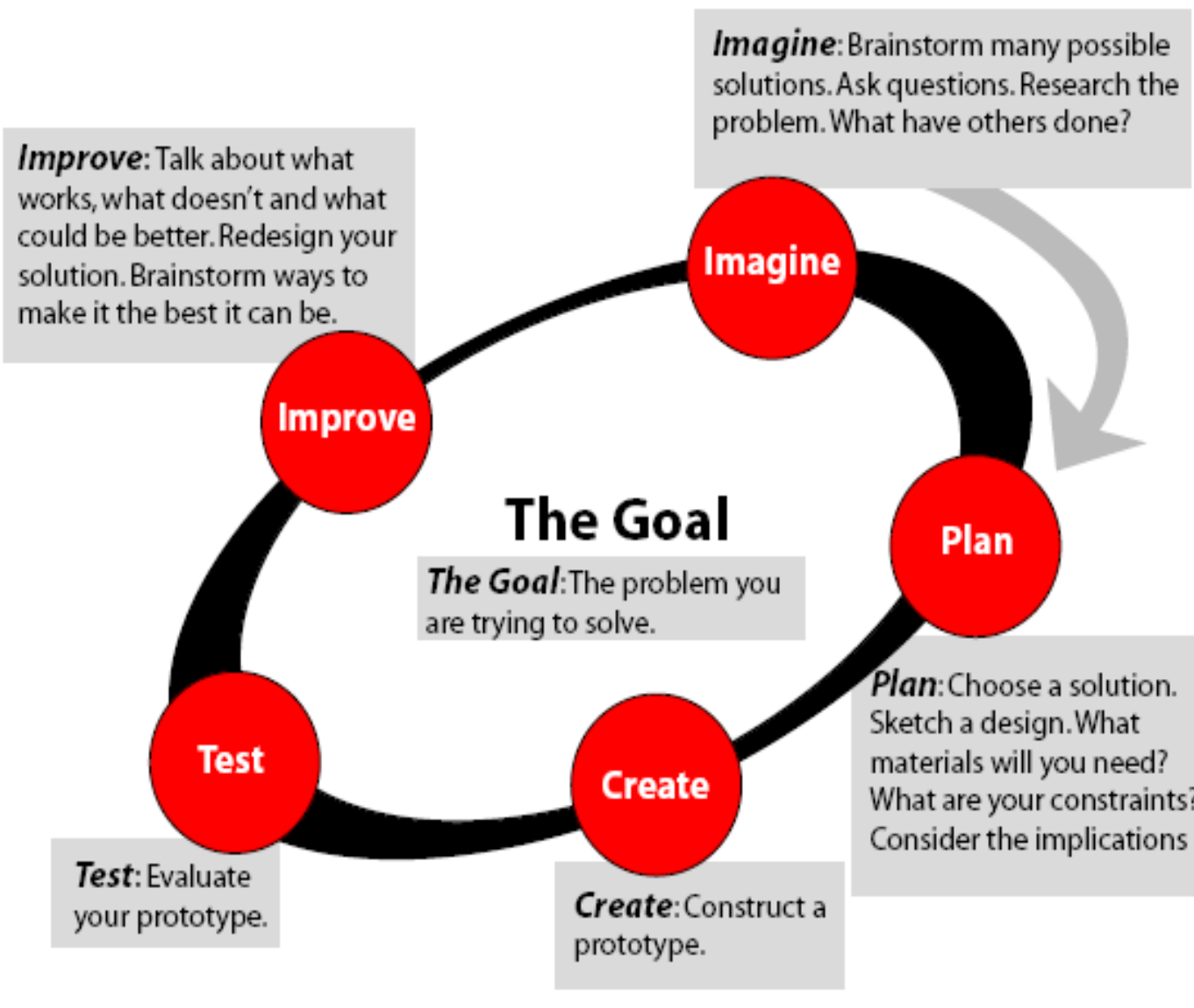
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How is Research Done?

The Inquiry Cycle



or Engineering Design Cycle



Comparison of the Scientific Method and the Engineering Design Process

The Scientific Method	The Engineering Process
State your question	Define a need
Do background research	Do background research
Formulate your hypothesis, identify variables	Establish design criteria
Design experiment, establish procedure	Prepare preliminary designs
Test your hypothesis by doing an experiment	Build and test a prototype
Analyze your results & draw conclusions	Test & redesign as necessary
Present results	Present results



Why should my students do independent research?

◆ **A research project:**

- teaches a student how scientists approach a problem and seek answers
- teaches lifelong learning skills, organization, and time management
- allows personal development as students become “experts” in their field of investigation
- encourages students to pursue their natural curiosity and questions that they are interested in answering!
- helps you to comply with the NC Standard Course of Study and graduation requirements



Why should my students do independent research?

◆ Allows students to integrate science across curricula and provides skills to students

- Elementary & Middle Schools
 - Reading & writing in content areas
 - Math analysis of data, graphing, charts
 - Computer skills in presentation, graphs, text
 - Interpretation of scientific data
- High Schools
 - All of the above
 - Meet requirements for Science Honors' Curricula
 - Increase science literacy, student interest in science, and motivation to pursue scientific careers
 - **Meaningful** senior projects



Developing the Project



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Make a Time Table

- Topic should not only interest you - but be do-able in the time that you have
- Develop time line for developing experiment and methods, experimentation, and analysis.
- Reserve time for putting together paper or project board
- Time table may be directed by teacher/mentor



Pick your topic

- Most difficult part
- Should come from something of great interest
- hobby or topic know something about
- Should not be too broad that it can not be answered through the investigation
- Begin keeping your journal/research log!



Research your topic

- Use internet - but look at sites, should look for “.edu” or “.gov”. NOT ALL INFORMATION IS CORRECT ON WEB! (Try using [Googlescholar.com](https://scholar.google.com) for journals)
- Use libraries – local resources and at NC State (as well as community and other colleges and universities)
- Talk to experts in the field - local and distant (NC State, Science Buddies, etc.)
- Create a bibliography of your sources
- Look for questions that you would like to answer.



Organize

- Look at what you have learned
- Think of questions that weren't answered.
- Narrow your focus for your topic to a particular idea.
- Develop that “testable” question!



Develop Research Plan

- Question being addressed
- Hypothesis/Problem
- Description in detail of method/procedures
- How will you analyze the data that you collect
- Bibliography - at least 5 sources!



Planning the experiment!

- Make an experimental design BEFORE collecting data!
- Explain what you are going to do, what will be involved, and what you are trying to find out.(remember that “testable” question!)
- Need to have controls and document factors that influence experiment.
- Need to have limited variables so that you know what is changing and why.



- Design the process of your experiment
- Experiment should have large enough numbers to be valid.
- List materials needed
- List any safety issues and precautions
- Review types of data expected and how it will be analyzed



Before Experimenting!

- ✓ Have research plan reviewed by teacher (mentor) and get any approvals needed by ISEF rules or other groups' regulations before beginning project!

In 2011-2012, all NC students must use the ISEF Forms 1, 1A, 1B, plus any required ISEF special forms. Please review NCSEF web site for additional information:

www.ncsciencefair.org/index.php/students-a-parents/forms



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Begin the experiment

- Keep detailed notes of every step and experiment in your journal/research log.
- Use data tables or charts as you proceed to help you see trends in data.
- Have quantitative data, but also record observational data.



Analyze Results

- After experiments, examine and organize findings
- Use graphs to show data
- Identify patterns in data
- Look for experimental error and where they could occur.
- Look at statistical relationships in data.



Draw Conclusions

- Did the variables that you tested show or cause a change?
- Were you able to see relationships?
- Did you collect enough data?
- Was your hypothesis supported?
- How did your data fit previous information that you found in your background research?
- What are practical applications or inferences that you can make?
- How would you change the experiment or future research area?



Present Findings

- Write an abstract of your project.
- Prepare a scientific paper, PowerPoint, or poster to present your findings.
- Present your project to class, school, or organization.



Benefits for Students

- Good preparation for college
- Good preparation for business
- Gives students the opportunity to present at professional conferences
- Gives students the opportunity to compete in academic settings
- Gives students insight into careers
- Builds confidence



Benefits for Learning

- Increases organizational skills
- Enhances process skills
- Improves writing skills
- May be **interdisciplinary**
- Requires **creativity**
- Improves visual/spatial thinking skills
- Improves communication skills



Using Student Research Projects for Science Competitions

- Local, Regional, State, and International Science Fair Competitions
- Broadcom MASTERS
- I-SWEEEP (International Energy, Environment, and Engineering) and 3E Sustainable Future Challenge
- Student Academy of Science Competition
- Junior Science & Humanities Symposium
- Intel Young Scientist's Award
- NC International Science Challenge
- Siemen's Competition



North Carolina has attended Intel ISEF since 2004. Our State Science Fair students have received numerous ISEF Awards:

- Two First Place Grand Award winners (2006, 2008)
- Four Second Place Grand Award winners (2005, 2009, 2011)
- Four Third Place Grand Award winners (2004, 2006, 2007, 2008)
- Ten Fourth Place Grand Award winners (2004, 2006, 2007, 2008, 2009, 2011)
- Two \$3000 Army Savings Bond Awards and an all-expense paid trip to London for the International Student Science Summit (2006)
- American Veterinary Award - \$1,000
- GE Energy Award - 1st Place - \$2,500 (2009)



More.....



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More ISEF Awards

- Ricoh Sustainable Development Award - \$12,500 (2009)
- Four \$3000 Air Force Scholarships (2006, 2008, 2009, 2011)
- A \$300 Scholarship from Sigma Xi for Interdisciplinary Team Research (2006)
- An eight week student internship with NOAA (2005)
- Two AVASC Foundation – 1st award - \$1,000 (2007, 2008)
- Society for Technical Communication: Merit Team Award of \$100 (2007)
- United Technologies Awards - shares of common stock (2009)
- American Geological Society – 2nd place - \$750 (2009)
- Association for Women Geoscientists – 2nd place - \$150 (2009)



ISWEEEP – International Sustainable World of Energy, Environment, and Engineering Project Olympiad (2008 - 2011)

ISWEEEP in Houston, TX

- Silver Award in Senior Energy
- Silver Award in Senior Engineering
- Silver Award in Junior Energy (2)
- Bronze Award in Senior Environmental (2)
- Bronze Award in Senior Engineering
- Honorable Mention in Senior Engineering (2)
- Naval Science Award
- Special Award – Infrastructure Corporation
- Special Award – Univ. of TX in Molecular & Cell Biology

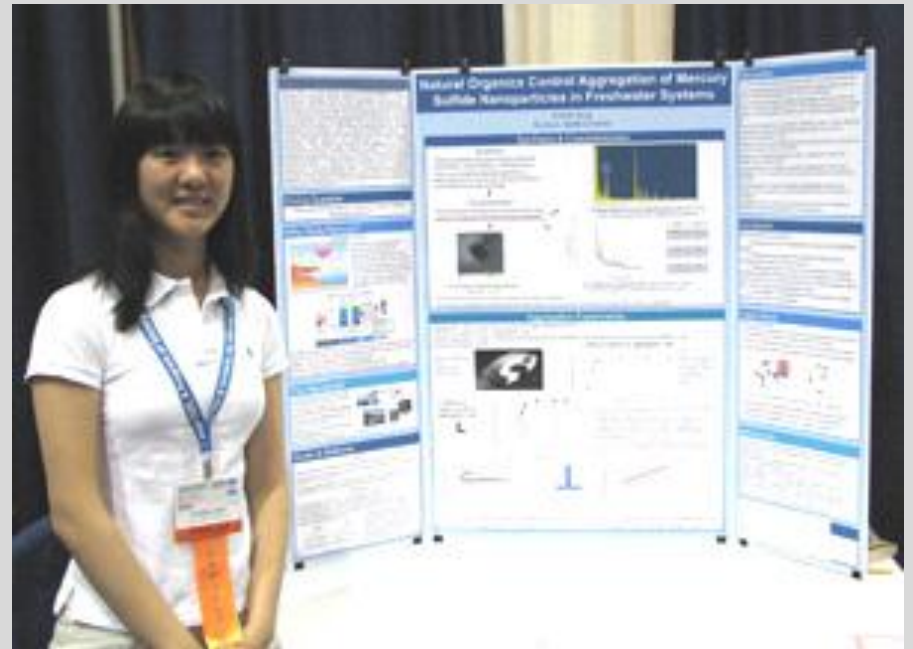


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Additional Awards

NC Student is Winner of the
U.S. Stockholm Junior Water
Prize in 2009

NC Student wins the INTEL
Young Scientist Talent
Search in 2008 for \$100,000



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NCSEF Students in National and International Competitions 2011

•2011 ISEF

- US Air Force
- American Veterinary Assoc.
- US Naval Research
- University of the Sciences, Philadelphia, PA scholarship
- 3 – 4th place Grand Awards
- 2nd place Grand Award

•2011 ISWEEEP

- Bronze Award in Engineering
- Bronze Award in Environmental

•2011 Genius Olympiad in Oswego, NY

- Gold Science Winner
- Silver Science Winner

•2011 Broadcom MASTERS

- 8 – Semifinalists from NCSEF!
- 2 – Finalists from NC (of 30 nationally) – Topsail Middle School and St. Timothy's School in competition Oct. 1-4, 2011 in Washington, D. C.



Resources for Science Projects

- Science Buddies: www.sciencebuddies.org, information for students, teachers, and parents
- Science Project Ideas, information and support for Science Fair ...www.scienceproject.com/
- Science Fair Projects - Project Ideas Demonstrations and Instructions:
chemistry.about.com/od/sciencefairprojects/Science_Fair_Projects.htm
- ISEF Science Primer: <http://www.societyforscience.org/isef/primer/index.asp>
- Agricultural Ideas for Science Fair Projects:
www.ars.usda.gov/is/kids/fair/ideas.htm
- Cool Science Fair Project Ideas and Science Fair Projects:
www.sciencepage.org/scifair.htm
- Nexus Research Group - Science Fair Main page:
www.nexusresearchgroup.com/science_fair/sci_fair.htm
- Science Projects:
www.infoplease.com/homework/sciprojectsfaq.html
- Research Project Ideas: Applying Science to Sustainability:
www.ithaca.edu/faculty/sallen/Sustainability/research.html
- Neuroscience For Kids - science fair:s
faculty.washington.edu/chudler/fair.html



<http://www.sciencefair.org>

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