Planning for the Future: Revising the Past

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Mentor: Dr. Greg Good
Women and Minorities are Underrepresented in the Physical Sciences
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- **Chart**: Male and Female High School Physics Teachers' Self-Assessed Levels of Preparation
  - **Variables**:
    - Basic physics
    - Applying physics
    - Use of demonstrations
    - Computers use
    - Recent developments
  - **Data**:
    - Men vs. Women

- **Table**: Women Among Physics Faculty Members
  - **Columns**:
    - Year
    - Rank (Full Professor, Associate Professor, Assistant Professor, Instructor/Adjunct, Other Ranks)
    - Highest Degree Offered (PhD, Master's, Bachelor's)
  - **Data**:
    - 2002:
      - Full Professor: 5
      - Associate Professor: 11
      - Assistant Professor: 16
      - Instructor/Adjunct: 16
      - Other Ranks: 15
      - PhD: 7
      - Master's: 13
      - Bachelor's: 14
    - 2006:
      - Full Professor: 6
      - Associate Professor: 14
      - Assistant Professor: 17
      - Instructor/Adjunct: 19
      - Other Ranks: 12
      - PhD: 10
      - Master's: 14
      - Bachelor's: 15
    - 2010:
      - Full Professor: 8
      - Associate Professor: 15
      - Assistant Professor: 22
      - Instructor/Adjunct: 21
      - Other Ranks: 18
      - PhD: 10
      - Master's: 15
      - Bachelor's: 17
    - 2014:
      - Full Professor: 10
      - Associate Professor: 18
      - Assistant Professor: 23
      - Instructor/Adjunct: 23
      - Other Ranks: 20
      - PhD: 10
      - Master's: 18
      - Bachelor's: 16

- **Website**: www.aip.org/statistics
Goals of the Project

Produce **teaching guides**

about the history of women and **minorities**

in the **physical sciences**

- Lesson plans
- Worksheets
- PowerPoints
- Readings

- African Americans
- Native Americans
- Disabled Americans

- Physics
- Astronomy
- Earth Science
- Chemistry
Goals of the Project

Provide students with a diverse set of role models

Isaac Newton  Albert Einstein  Niels Bohr
Goals of the Project

Provide students with a diverse set of role models

Solvay Conference in Brussels, 1927
Goals of the Project

Provide students with a diverse set of role models

Katherine Johnson  
Lise Meitner  
Chien-Shiung Wu  
Herman Branson

Photos from the AIP Emilio Segre Visual Archives
Goals of the Project

Raise awareness of ongoing diversity issues in the physical sciences
Building on Three Years of Work

Previously:
Teaching Guides on Women and African Americans in Physics, Astronomy and Related Disciplines

Lesson Plans

- Women
  - 8 in final format
  - 16 not in final format

- African Americans
  - 3 in final format
  - 16 not in final format
Complete Standardization of Lesson Plan Format

The 5 E’s

<table>
<thead>
<tr>
<th>Instructional Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engage: Minutes</td>
</tr>
<tr>
<td>Explore: Minutes</td>
</tr>
<tr>
<td>Explain: Minutes</td>
</tr>
<tr>
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Building on Four Years of Work

More than just lesson plans
- Slideshows
- Annotated bibliographies
- Timelines
- Informational handouts
- Guides to online, AIP, archival resources
- Lists of oral histories and video interviews
- Historiographies
- Puzzles and games
Supplemental Materials

What we included

Discussion questions/answers
PowerPoints
Worksheets
Informational handouts
Readings
Revising Previously Existing Lesson Plans

African American Physicists in the 1960s

Herman Branson

Tannie Stovall
Revising Previously Existing Lesson Plans

African American Physicists in the 1960s
Revised Lesson Plans

Follow the Drinking Gourd - Before

https://www.youtube.com/watch?v=pw6N_eTZP2U
Revised Lesson Plans

Follow the Drinking Gourd - After

http://astro.unl.edu/naap/motion2/animations/ce_hc.html

Rotating Sky Explorer Activity

Student Instructions

1. In your groups, go to the University of Nebraska-Lincoln Rotating Sky Explorer at http://astro.unl.edu/naap/motion2/animations/ce_hc.html.
2. In the Star Controls section, select “Big Dipper” in the Star Patterns dropdown menu.
3. In the Star Controls section, click “Add a Star Randomly.”
4. Click on the star that was added.
5. In the “Celestial Sphere View”, set right ascension = 2.5 h and declination to 89.2°. This star is Polaris, the North Star.
6. In the Appearance Settings section, select “show labels”.
7. Click “Start Animation.”
8. Play with the different options in the simulation.
9. Think about how the sky looks from different locations and how the sky changes over time.
Many Thanks to

Dr. Greg Good

Samantha Spytek, Stephen Neal, Lance Burch

The Niels Bohr Library and Archive staff

Dr. Brad Conrad, Courtney Lemon

The Society of Physics Students

The American Institute of Physics
Planning for the Future: Educating the Present

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We Have Standards Here

Common Core Standards

- Reading: Literature
- Reading: Informational Text
- Speaking and Listening
- Language
- History/Social Studies
- Science & Technical Subjects
- Subject Writing
Next Generation Science Standards

| Dimension One: Practices | 1. Asking Questions and Defining Problems  
|                          | 3. Planning and Carrying Out Investigations (Extension)  
|                          | 4. Analyzing and Interpreting data (Extension)  
|                          | 8. Obtaining, Evaluating and Communicating Information |
| Dimension Two: Crosscutting Concepts | 1. Patterns  
|                     | 2. Cause and effect  
|                     | 4. Systems and system models  
|                     | 7. Stability and change |
| Dimension Three: Disciplinary Core Ideas | PS2.A: Forces and Motion  
|                                      | PS2.C: Stability and Instability in Physical Systems  
|                                      | ESS2.A: Earth Materials and Systems  
|                                      | ESS2.C: The Roles of Water in Earth’s Surface Processes  
|                                      | ETS2.A: Interdependence of Science, Engineering, and Technology |
Creating New Lesson Plans

Start with a list
Do some research
Decide what the kids should learn
Choose the subject
You are kidnapped by political-science majors (who are upset because you told them political science is not a real science). Although blindfolded, you can tell the speed of their car (by the whine of the engine), the time of travel (by mentally counting off seconds), and the direction of travel (by turns along the rectangular street system). From these clues, you know that you are taken along the following course: 50 km/h for 2.0 min, turn 90° to the right, 20 km/h for 4.0 min, turn 90° to the right, 20 km/h for 60 s, turn 90° to the left, 50 km/h for 60 s, turn 90° to the right, 20 km/h for 2.0 min, turn 90° to the left, 50 km/h for 30 s. At that point, (a) how far are you from your starting point, and (b) in what direction relative to your initial direction of travel are you?

In Fig. 4-49, a radar station detects an airplane approaching directly from the east. At first observation, the airplane is at distance \( d_1 = 360 \text{ m} \) from the station and at angle \( \theta_1 = 40° \) above the horizon. The airplane is tracked through an angular change \( \Delta \theta = 125° \) in the vertical east–west plane; its distance is then \( d_2 = 740 \text{ m} \). Find the (a) magnitude and (b) direction of the airplane’s displacement during this period.
Creating New Lesson Plans

Scientific Writing
Learn by Explaining

A sudden blast depresses each ear equally and successively in the direction of the wind, but in consequence of the elasticity of the stalks and the force of the impulse, each ear not only rises again as soon as the pressure is removed, but bends back nearly as much in the contrary direction, and then continues to oscillate backward and forward in equal times, like a pendulum to a less and less extent, till the resistance of the air puts a stop to the motion. These vibrations are the same for every individual ear of corn. Yet as their oscillations do not all commence at the same time, but successively, the ears will have a variety of positions at any one instant. Some of the advancing ears will meet others in their returning vibrations, and as the times of oscillation are equal for all, they will be crowded together at regular intervals. Between these there will occur equal spaces, where the ears will be few, in consequence of being bent in opposite directions, and at other equal intervals they will be in their natural upright positions. So that over the whole field there will be a regular series of condensations and rarefactions among the ears of corn, separated by equal intervals where they will be in their natural state of density. In consequence of these changes the field will be marked by an alternation of bright and dark bands. Thus the successive waves which fly over the corn with the speed of the wind, are totally distinct from, and entirely
Creating New Lesson Plans

Scientific Writing
Learn by Explaining
Creating New Lesson Plans

xkcd SIMPLE WRITER
WRITE LIKE UP GOER FIVE AND THING EXPLAINER

PUT WORDS HERE

I am writing to show you how to use this right/wrong word box. You write words that you think will work, and if they do they look like all of the ones you've seen so far, and if they don't they look like this: indicator.

YOU USED SOME LESS SIMPLE WORDS

indicator

https://xkcd.com/386/

https://xkcd.com/1133/

https://xkcd.com/simplewriter/
We have all of this content… Now what?

https://www.aip.org/history-programs/physics-history/teaching-guides-women-minorities/landing-page-
With a New Website Comes New Content

http://www.hispanicphysicists.org
It Takes a Village

We’d like to thank…

our advisor, Dr. Greg Good

our graduate students, Lance Burch and Stephen Neal

our coordinators Brad Conrad and Courtney Lemon
It Takes a Village

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The web design team Jenny Krivanek, Tom Connell and Nathan Cromer
Questions?