Strategic Local Partnerships for Engaging Undergraduate Science Students in Opportunities of Civic Importance

A Case Study Approach Involving Majors and General Education Science Courses

G. Reid Bishop, PhD
Associate Professor and Chair, Department of Chemistry Belhaven University
Chair, Division of Natural Sciences
The Fight Continues

- Scientists VS Non-Scientists
- Non-Science Majors Courses VS General Education Science Courses
- Science Knowledge VS Science Skills
- Esoteric Knowledge VS Relevant Applications
- Disconnected VS Local/Regional
- "Canned Experiences" VS Discovery (Research!)
- Exclusive VS Inclusive
- Inaccessible VS Accessible
- Society VS Culture
OVERVIEW

- Non-science students suffered through pre-professional courses and laboratories.
- Entry level science courses focus more on terminology and basic ideas to prepare for more advanced science education.
  - They are not an end in themselves.
- Students are well versed in internet-based learning but do not know what science resources are available, how to access them, nor how to apply them.
- Students do not know how to synthesize information and data.
THE VISION

- Provide a format that fosters wonder, and curiosity of the natural world
  - Utilize current events, overarching issues and “big problems” and real world problems
- Partner with local institutions to provide local civic engagement (local relevance) to form “citizen scientists”
- Emphasize scientific method, integration/application of data analysis, and relevance
- Expose students to scientific resources
  - GPS, Cell phone, google earth/maps, “big data” (public data resources)
- Demonstrate the multidisciplinary approach to actual science projects including non-science areas
- Provide relevant laboratory experiences
- Cover important content
PRACTICAL APPLICATION

- Partnerships established with
  - Jackson Zoo (jacksonzoo.org)
    - Master plan data gathering and resource management
  - Wildlife Mississippi (wildlifemiss.org)
    - Pearl river wetland mitigation project
  - US Army Corps of Engineers (usace.army.mil)
    - Mississippi River projects

- Utilize SENCER (Science Education for New Civic Engagements and Responsibilities) model as an approach to make science more real, accessible, "useful", and as a driving vehicle for content delivery
  - See Sencer.net for more info
The SENCER (Science Education for New Civic Engagements and Responsibilities) model

- Connects teaching/science to unresolved/current public issues allowing basic science to shine
- Invites students to put scientific methodology to use on matters of immediate interest (Increase motivation)
- Helps reveal limits of science by showing where science can have a voice in different issues
- Conceives of science as practical, integrated and engaged activity instead of as a “storage shed” that must be built upon
- Seeks to engage students with science and civic questions that require attention now to help students overcome fears of science and unquestioning awe of science
CONTENT MOTIVATING ISSUES

- **Mars Orbiter Loss**
  - Measurements, Units, Kinematic Variables, Forces, Gravity
- **Eutrophication in Gulf of Mexico - Deadzone**
  - Chemical concepts, Geological concepts
  - Electric forces/charge, Bonding & Electrons
- **Renewable Energy/Resources**
  - Thermodynamics, Electricity, Materials (photovoltaics), Nuclear Physics, Energy
- **Mississippi River/Pearl River**
  - Fluids/Fluid dynamics, Hydraulics, Water Quality, Conservation
- **Jackson Zoo**
  - GPS technology, Thermodynamics, GIS technology/mapping, Data analysis
CHALLENGES

• No textbook or course materials!!
  • OpenStax (openstaxcollege.org) “College Physics”
  • “Sustainability: A Comprehensive Foundation” by Tom Theis and Jonathan Tomkin

• Student apprehension and anxiety
  • Unknown factors – grading, style, assignments, labs etc.

• Designing labs
  • Data analysis and collection related to local projects
  • Designing small lab modules focusing on content related to upcoming deliverables/presentations

• Establishing partnerships
• Overcoming student misconceptions of science
• Time constraints/logistics
JACKSON ZOO PROJECT

- Historical Zoological Park
  - 380 animals, 125 species, 14 endangered species
  - $2.3 million annual operating budget
  - 110 Acres, 54 acres developed
  - ~127,000 visitors annually, 35,000 school children
  - Some Old Infrastructure – Started in 1919, some buildings built in 30s by Works Progress Administration (WPA)

- Crafting a master plan
  - Including new facilities, parking, exhibits

- Need data to be more effective
  - Water usage, Thermal analysis, Amenities for guests, Most used spaces, Elevation/mapping, Water run-off, Air quality, Invasive Species, etc.
Photograph No. 1
Large volume of water coming from ground around foundation and into concrete storm drain pipe under boardwalk.

Photograph No. 2
Looking northeast at champanzee root from drainage ditch. Large water flow from ground at concrete foundation.

Photograph No. 3
Pink flagging marking location of "something" underground. Dashed lines indicate approximate limits (7 to 8 feet wide).
## Visual Water Level Readings
**Jackson Zoo Chimpanzee Moat**

<table>
<thead>
<tr>
<th>Date</th>
<th>Elapsed Time (hours)</th>
<th>Gauge Reading (feet)</th>
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<th>Incremental Rate of Change (feet / hour)</th>
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**Notes:**
Rainfall 0.42 inches (Hawkins Field) between 08:00 and 11:00 1/21/2016
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CONCLUSIONS FROM INITIAL EXPERIMENTS

- Mapping Study
  - Low point in park is the creek
  - High point in park is the water tower area
  - Drainage outside of park is uncapped; hazard to children
- Thermal Study
  - Barn is as cool as air conditioned space; consider more spaces like that
  - The bear and snow leopard enclosures are unbearably hot
  - All exhibits with water around them are cool and even below ambient
  - Every playground is too hot to play on; suggest simple shade
  - The natural spaces are cooler; consider keeping spaces more wild rather than too many manicured spaces
- Water Study
  - Creek is very clean; but not surprising since the “solution to pollution is dilution”; Where does all the water come from? Who is paying for it? If it’s free why not make use of it?
  - Working on ramping up the water quality aspects
- Air Quality
  - An air quality study is being plan
- Invasive Plant Study
MEDIA COVERAGE

• WJTV News Coverage
  • http://wjtv.com/2015/09/03/belhaven-students-partner-with-jackson-zoo-for-research/

• Clarion Ledger Photo Gallery
  • http://www.clarionledger.com/media/cinematic/gallery/71664684/belhaven-u-students-conduct-research-at-the-jackson-zoo-gallery/

• Clarion Ledger Video
  • http://www.clarionledger.com/media/cinematic/video/71662448/belhaven-students-conduct-research-at-the-jackson-zoo/

• Clarion Ledger Story

• Mississippi Public Broadcasting (Mississippi Edition) (Note: scroll down the page for the story)
  • http://www.mpbonline.org/blogs/mississippiedition/mississippi-edition-wednesday-september-9th/

• *Mississippi Roads (Future Project)
ACKNOWLEDGEMENTS

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- Belhaven University
  - President – Dr. Roger Parrot
  - Provost – Dr. Dan Fredrick
  - Assistant provost – Dr. Dennis Watts
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- Wildlife Mississippi
- Shimadzu Instrument Corporation