Undergraduate Research and Civic Engagement

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Background
Team Research
Curriculum based Research
Future Projects
Undergraduate Research (UGR)

• UGR is a demonstrated high impact practice.
• UGR forms:
  – 1:1 independent work
  – Team research and senior capstone courses
  – Curriculum-integrated research projects (this alternative is highlighted NAS report 2015 Integrating Discovery-Based Research in the Undergraduate Curriculum.)
• STEM education reform initiative that focuses on integrating civic issues and STEM learning

• Science education reform began with NSF support (in 2001) and continues with numerous signature projects (Summer Institute and Regional Meetings, GLISTEN, Engaging Math, and SENCER-ISE).

• Plus there are the SENCER model courses and the Science Education and Civic Engagement journal (http://seceij.net/index.html)
Opportunity to Integrate

**Undergraduate Research Goals**

- Teach students new skills
- Collect & analyze student data
- Engage students in deeper learning of concepts (in discipline).
- Link new student research to previous knowledge in discipline.
- Assist students in communicating data

**SENCER Goals**

- Student new skills and learning are linked to previous knowledge and civic issue
- Use public data or create data for public or private agencies
- Students integrate knowledge in the discipline with the civic issue.
- Students retain their new learning and have some attitudinal changes.
- Students learn to communicate science concepts and data to others.
SENCER Research Team Examples

• Math/Computer science students created an App as independent research course.
  – https://www.youtube.com/watch?v=GNzT8KhQtlw

• Pesticides Sampling on the Duwamish River; Doug Latch, P.J Alaimo, and Lindsay Whitlow, Seattle University.

Course-based Research Projects

• Ecology, Organic and Analytical Chemistry
  – Seattle University Multiple course team research
• GIS and Remote Sensing
  – Measurements at local marsh yields valuable bathymetric data
• Environmental Chemistry
  – Soil screening work at community sites
  – Water quality work dependent watershed issues
• General Biology and Science courses – Education Outreach via the KQED partnership; multimedia and
  – Students create media project to educate others on a topic associated with their course learning.
  – Example: [http://ww2.kqed.org/education/2016/05/11/should-animals-be-kept-in-zoos/](http://ww2.kqed.org/education/2016/05/11/should-animals-be-kept-in-zoos/)
McNabney Marsh Map Fall 2015
Environmental Chemistry Lab

- Introduced into 2002 Environ. Chem. Lab (Lead in Paint lab)
  - Demo with Lead abatement program in Richmond
- Fully incorporated XRF lab in 2004 via highway soil screening (instructional lab)
  - Sites (APC housing and Alameda park, SMC residence hall, DTSC Marin salt marsh & CCCSan holding pond).
2012 XRF Soil Screening for Lead
(mini-research projects)

• Students apply U.S. EPA Method 6200 on site.
  – Previously trained on instrument (*in situ* measurements) and field sampling at highway site
  – Use of NIST SRM to validate XRF spectral results

• Students’ reflection activity evaluates data and using DTSC Lead Spread 7 and 8 (locked spreadsheet).
  [https://www.dtsc.ca.gov/AssessingRisk/LeadSpread8.cfm](https://www.dtsc.ca.gov/AssessingRisk/LeadSpread8.cfm)

• Students write letters to site management agency on lead risks.

• Student data has been included into some documents used to determine future site uses.
  – Project work supports gaining access to additional sites.
Student Course Outcomes
(Environmental Chemistry)

• Using SALG 2012 assessment tool (www.salgsite.org)
  – Students were asked in pre/post surveys about their knowledge of the utility of screening methods. Understanding the value of these tools were expressed on a 5 point scale (disagree to agree) Pre value 3.6 Post value = 4.4 .
  – Due to small class sizes, I have not collected a large amount of statistically valuable data.
  – Students express that reflection activity gives insight on the data. (open-ended & informal)
  – Students find the community engagement is empowering. (open ended & informal)
Projects

• SENCER partners with KQED to address civic issues:
  – Goal: students educate the public and themselves
  – students research an issue
  – students work to effectively communicate aspects

• Examples are tied to Human Health, Wildlife Conservation, etc.

• Impact: 10 different SENCER institutions; 14 projects since 9/2014; 11 projects have more 1000 pageviews.
# Do Now U

## Project
(results KQED website just 2016)

- **Topics**
- **Educational Institutions**
- **PageViews of created materials** (last 2 in list posted within the last month)

<table>
<thead>
<tr>
<th>Post</th>
<th>Institution</th>
<th>Cumulative Pageviews</th>
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<tbody>
<tr>
<td>Will the Flint Water Crisis Motivate More Efficient Responses in the Future?</td>
<td>Lonestar College-Kingswood</td>
<td>1294</td>
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<tr>
<td>Is Milk Good or Bad For You?</td>
<td>Lipscomb University</td>
<td>2401</td>
</tr>
<tr>
<td>Are the Benefits of Organic Food Worth the Price?</td>
<td>Lipscomb University</td>
<td>3099</td>
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<tr>
<td>What Influences Your Dietary Choices?</td>
<td>Mercer University</td>
<td>1324</td>
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<tr>
<td>Should the Federal Minimum Wage Be Increased?</td>
<td>Pennsylvania State University- Mont Alto</td>
<td>2136</td>
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<tr>
<td>Should Animals be Kept in Zoos?</td>
<td>Saint Mary's College of California and the Lindsay Wildlife Experience</td>
<td>1621</td>
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<tr>
<td>Should We Make Cities More Inviting to Wildlife?</td>
<td>George Mason University</td>
<td>680</td>
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<tr>
<td>Should Genetically Modified Mosquitoes be Used to Stop the Spread of Zika?</td>
<td>Southern Connecticut State University</td>
<td>113</td>
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**KQED**

*website just 2016*
Ongoing & Future Projects

• GIS mapping projects
• Continued Soil Screening Projects
• Additional Do NOW U projects (rats?)
• TWU Native Plant Garden (fulfills educational study zone)
• TWU (air emission at idle)
TWU Pollinator Garden

• A sustainability education tool, particularly regarding water and pollinator conservation: the Garden will:
  – create habitats for insects and birds and be places of beauty
  – serve as observatories and laboratories as well as beautiful habitats

• We will directly involve students from many disciplines in planting, maintenance, research and educational outreach.
Project Goals

The overall goals of this project are:

• Improving students’ awareness of critical environmental issues such as climate change, habitat loss, water conservation, and air pollution
• Involving students, through interdisciplinary teamwork and application of classroom concepts, in developing solutions to these issues
• Providing on-campus habitats for faculty and student research
• Enhancing public awareness of crucial environmental issues in our communities and educating public partners on steps they can take to address these issues
Related Research

The pollinator gardens will support our Quality Enhancement Plan for students to “learn by doing.” Research activities will include

- water use/waste and water quality before/after runoff as compared to non-native lawn areas
- soil testing
- ecological studies (biotic factors through direct observation but also paw prints, droppings, and use of motion sensor cameras for nocturnal wildlife studies; abiotic factors)
- plant-pollinator interactions in the context of learning how native plants support ecosystems in a way that is preferential to non-natives for wildlife
No Time to Idle: Air Quality in Drive-thru Lanes

U.S. Department of Energy research in 2012 (http://energy.gov/sites/prod/files/2014/02/f8/idle-stop_light_duty_passenger_vehicles.pdf) showed that 10 seconds is the maximum time a small passenger car can sit at idle before it contributes more fuel emissions than it would if the driver turned the engine off and restarted it when they are ready to move forward.

*No Time to Idle* aims to reduce fuel emissions and improve air quality in the Denton area by reducing the time that vehicles idle in drive-through lanes.
No Time to Idle Project Goals

*No Time to Idle* is intended to be the pilot phase of a public education campaign in Denton to

- reduce fuel emissions
- advocate for the implementation of appropriate signage to remind drivers to turn off their engines when they are idle in a drive-through lane
No Time to Idle Research Plans

Later phases of this work will seek to measure actual emissions from vehicles and other more complicated assessments comparing cars that are turned off while standing in a drive-through (stop/start method) to the stand/idle method. Air sensor monitors and more traditional laboratory analysis of air samples are being considered for use by students in analytical and instrumental chemistry courses.
Acknowledgements

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• CILSA and Alameda Point Collaborative (APC)
• Screening sites: APC, Cal-Trans, DTSC, etc.
• Camille and Henry Dreyfus Foundation (Special Grant Program # SG -04-083)
• KQED educational partnership
• Lindsay Wildlife Experience
References

Team Research

• App creation: http://math.stmarys-ca.edu/outreach/lindsay-wildlife-app-project/

Curriculum-based Research

• GIS mapping: http://serc.carleton.edu/sencer/environmental_bio/index.html (this is a SENCER model course).
• Educational Projects to inform the public
  – KQED Do Now U – Should animals be kept in zoos? http://ww2.kqed.org/education/2016/05/11/should-animals-be-kept-in-zoos/

General Active Learning (Constructivist methodology)

• Cal-Trans received report.
  – After a car fire on the site, Cal-Trans covered site with mulch to minimize dust.
  – Additional high lead areas were covered with cement.
• Mount Diablo Unified School District
  – Sent a letter acknowledging the first report.
  – Kindergarten and Entryway repainted.
• APC sent letter of thanks after first receiving report.
  – APC invited class to partner and analyze proposed Alameda City Park site
• DTSC was supportive of sampling in 2014 at a marsh site and aided access to the site for 2016.
• The Chemistry Department gained better contact with U.S. EPA.
Communication - Dual Poster Project

• SENCER faculty have directed students to create two posters
  – discipline specific
  – media/general public
  – This work educates students and general public.

• SENCER faculty applied this method (NCUR 2010; SENCER Washington DC Symposium, TWU, etc.).