Learn by Doing

A Hands-On Experiences for Future Green Building Professionals through Coursework

Presenters:

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Barry Williams, MS, LEED™ AP, RA, Architecture, Cal Poly, San Luis Obispo

The view presented here is strictly our view and not the view of anyone who has the power to terminate our job.
A. The CSU Proposal - an opportunity

The ‘Campus as a Living Lab’ Grant Program is a unique opportunity to partner faculty and facilities management staff in using the campus as a forum for the exploration of sustainability concepts and theories. The program aligns the California State University’s long-standing commitment to sustainability with the fundamental goal of preparing students for the workforce.
B. Opportunity Decisions- The ‘Campus as a Living Lab’ Grant Program will provide funds for two schemes:

1. The development or redesign of a course that ties elements of sustainability into opportunities for learning using the campus physical plant. Funds of up to $12,000 will be awarded to support the preparation of the proposed course.

2. The creation of an Interdisciplinary Learning Community, focused on campus sustainability. The learning community may be comprised of faculty, staff, students, and community college partners. Funds of up to $12,000 will be awarded to support the activities of the proposed Learning Communities.
C. Our application – We saw both options as viable avenues.

The vision behind our proposal was to:
• The vision behind this project is to leverage this asset by transforming selected rooms into laboratories that serve the CSU and local communities as prototypes for evaluating the effectiveness of sustainable strategies in their environment.
• use the multi-disciplinary resources available on campus.
• put together a team of student and faculty problem solvers.

Note: In all of our focus on the grant writing we missed the opportunity to attend a grant writing workshop.
A. The Search for a suitable room, a discussions with Stakeholders
   1. Building Facilities personnel
   2. College Dean
   3. School Department Head
B. Logistics - The Search for a suitable room
   1. Classroom
   2. Office
   3. Multi-use

The Winner!!
INTERIOR
The selected space becomes our studio lab.
Scope
Our grant proposal was based on using a radiant floor delivery system.

Early in the design preparation the following systems were discussed

1. Radiant floor
2. Wall or Baseboard
3. Ceiling panels
D. Cost – proposed for Grant:

For the preparation of the Grant we were very conservative with our cost projections.

Course Development incl. salaries and benefits $8,300

Project soft costs -
Includes the design and engineering costs and permitting fees $3,500

Construction costs -
Includes coring of the slab and walls, radiant system complete, topping slab and monitoring $12,000

Total project costs – $23,800
E. Cost – proposed by Facility Services:

Or so we thought – the facility services project manager had a different take

Project soft costs - $27,228.03
Includes the design and operation of a course on campus, engineering costs and permitting fees.

Construction costs - $48,430.92
Includes coring of the slab and walls, radiant system complete, topping slab and monitoring.

Total project costs - $75,658.95

Associated teaching costs - $8,300 (from our budget)

Only $62,185 difference
Teaching Objectives:

• Work with stakeholders to understand their concerns and requirements.

• Apply research techniques to solve real problems through analysis and synthesis.

• Design buildings that respond appropriately to solar geometry, daylight, and meet the requirements for human comfort.

• Understand and apply the principles of heat transfer.

• Learn to prioritize design decisions.

• Translate design drawings into appropriate construction documents.
Laboratory Project Objectives

• to transform the selected room into a laboratory for the development and testing of a prototype for a sustainable cooling system.

• to design a system that can be used by campus facilities to address overheating throughout the campus and decrease overall energy use

• to make use of off-the-shelf construction products in order to verify the feasibility of this system within the building industry.
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Realization

New spring class offering - Keeping it Cool!

Arch 480
When: T, Tr 12 -1
Where: TBD
Who can enroll: 8-12 eager students

Advertising the studio
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Realization

The team

2015 CA Higher Education Sustainability Conference (CHESC)
### Prelim. Design on External Appearance of the Roof Collectors
- 1. 2D drawings in 1/8” scale,
- 2. 3D digital model,
- 3. Start physical model, scale 1/4”
- 4. Resulting construction requirements
- 5. Question catalog

### Prelim. Design on Roof Collectors and Radiant Floor
- 1. 2D schematic design
- 2. Component listing including
- 3. List of resulting requirements for building design
- 4. Resulting construction requirements
- 5. Question catalog

### Preparation for data capture, including but not limited to:
- 1. Initiate Weather station relocation for measuring outside conditions,
- 2. Research and if possible obtain sensors for measuring room performance,
- 3. Organize data collection set-up on lab computer
- 4. Document existing state (int. & ext.)

### Roadmap for Public Relation effort
- 1. Sort brainstorm results regarding target group and suitable timeframe
- 2. Develop campaign by sequencing PR events
- 3. Finalize draft templates for slide and hardcopy,
- 4. Start a weekly log

<table>
<thead>
<tr>
<th>BD Building Design</th>
<th>SD System Design</th>
<th>R&amp;D (Research&amp;Doc.)</th>
<th>PR Public Relations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prelim. Design on External Appearance of the Roof Collectors including but not limited to: 1. 2D drawings in 1/8” scale, 2. 3D digital model. 3. Start physical model, scale 1/4”. 4. Resulting construction requirements 5. Question catalog</td>
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POC: Curtis McNally  
POC: Dennis Elliot  
POC: Steve Spencer  
POC: Ray Ladd
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Realization

Building Design
Meeting with stakeholders

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Realization

**Rebar**
We are looking for the rebar schedule to ensure we don’t compromise the reinforcement of the walls and floors during installation

**Water Collection Tanks**
We need a final decision on the size and placement of the tank(s)

**Pipes**
We need a final decision on the size of the pipes that run from the collectors to the floor manifolds

**Path of Pipes**
Is it cheaper to run pipes through floors or walls?

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**Building Design**
Solve Problems – Generate Decisions
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Realization

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Building Design
Plan and Specify Construction
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Realization

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PIPING PLAN

System Design
Understand Technical Constraints
System Design
Understand system components and their interaction
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Realization

Research & Documentation
Investigate Existing Conditions

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Above: An example of some data the sensors gathered. Regular fluctuations come on a daily basis with the rising and setting of the sun.

**Research & Documentation**  
Student’s document diurnal swing in test space system plans
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Realization

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THE LIVING LAB

PHASE 1: RADIANT COOLING RESEARCH LAB
TRANSFORMING THE MEDIA LAB STEP BY STEP

COMING SOON

ARCH.CALPOLY.EDU/CONTENT/ARCH480

Public Relations
Poster / Flyer Design

2015 CA Higher Education Sustainability Conference (CHESC)
Public Relations
Renderings for Presentation to the College

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Realization

The Budget

**Remember the $62,185 bust?**
Using the real world solution of reducing expenditures and finding more funds we were able solve the problem.

Reducing expenditures was realized through:
- Project scope reduction ($32,600)
- Finding better bids ($6,400)
- Volunteer labor (unauthorized...covert) ($5,000)

($ 44,000)

More funds were obtained through grants
- Harold Hay Foundation $12,000
- Donated material $6,000

$18,000

**Total project costs** $35,800
After many long fought hours we came to the realization we had a viable project.
E-mail May 22 to Facility Services

“...Today we realized that there are actually tiles underneath the carpet, and that those tiles are glued to the floor slab.

The mastic underneath them is black. It looks kind of like tar, which I'm pretty sure is how you described asbestos to us.

I attached a picture of what I'm talking about. Could you or some other qualified individual come check this out to see if the tiles and mastic actually are asbestos, and if they are, advise us on how to deal with this?”
Construction

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Construction

Sustainability

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Construction

Commitment to Sustainability

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Conclusion

Lessons Learned:

Grant Writing  
- Be specific in your proposal,  
- Address each evaluation criterion,  
- Think big, and...  
- ...Don’t sweat if you miss the Grant Writing Workshop

Campus Construction  
- Has more stakeholders than you would ever imagine,  
- Puts you on the spot within your department,  
- Rule of thumb: Triple cost, triple schedule, triple trouble

Student Research  
- Group work is chaotic but creative  
- Real world project increases motivation  
- Off-campus involvement (consultants, contractors) is key

Administration  
- Department  
- College  
- Facility Services  
- Procurement  
- External Contractors
Outlook

What comes next?

Grant Writing
- Apply to mini grants for selected detail / finish
- Apply for sustainability grant to operate the system
- Reach out to industry partners for sponsoring
- Support for Phase II (cooling and heating, ceiling panels)

Campus Construction
- Wait for completion of re-roofing under the collector area
- Pressurize and fill the system
- Set-up circulation pump operating hours
- Install weather station and in-room sensors

Student Research
- Decide on undergraduate and/or graduate participation
- Use existing Research Plan for future research scope
- Expand laboratory scope beyond current system/topic

Administration
- Department: Schedule undergraduate class
- College: Regain room access
- Facility Services: Coordinate Phase II
Thank you for your interest
Any Questions?
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Opportunity

The two phases were estimated at:

1. Course design and implementation
   - Salaries / Benefits: $11,800
2. Interdisciplinary Learning Community through doing
   - Salaries / Benefits: $12,000

Total Grant: $23,800

Extra slide

<table>
<thead>
<tr>
<th>Expenses</th>
<th>Funds Requested</th>
<th>Matching Funds</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Salaries / Benefits</td>
<td>$6800</td>
<td></td>
<td>Project research investigation – applicant salaries Total = 136 hours</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>System Component Research - 32 hours</td>
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<td>Case Study Implementation - 32 hours</td>
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<td>Design Prototype Model - 24 hours</td>
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<td></td>
<td></td>
<td>System Documentation - 12 hours</td>
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<tr>
<td></td>
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<td>Cost Analysis - 12 hours</td>
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<tr>
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<td></td>
<td></td>
<td>Summary report &amp; Presentation - 24 hours</td>
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<tr>
<td>Salaries / Benefits</td>
<td>$1500</td>
<td></td>
<td>Project research investigation – student salaries Total = 100 hours</td>
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<tr>
<td></td>
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<td></td>
<td>CAD Support System Documentation - 20 hours</td>
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<td>CAD Support Case study - 20 hours</td>
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<td>Proto type model – 60 hours</td>
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<tr>
<td>Stipend</td>
<td>$0</td>
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<td>Travel</td>
<td>$0</td>
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<tr>
<td>Equip Supplies and services</td>
<td>$2500</td>
<td></td>
<td>Facility service review, project inspection. $1500</td>
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<td>Title 24 review – outside consultant - $500</td>
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<td>Materials for prototype model – $500</td>
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<tr>
<td>Hospitalit y</td>
<td>$0</td>
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<tr>
<td>Evaluation</td>
<td>$500</td>
<td></td>
<td>Costs for evaluating the physical impact of transforming the space. This would be a graphic and written document. Part f the cost is included in Salaries and benefits</td>
</tr>
<tr>
<td>Dissemination</td>
<td>$500</td>
<td></td>
<td>On campus PR and awareness. Some cost for graphics for handouts and website interface</td>
</tr>
<tr>
<td>Totals for this Phase</td>
<td>$11800</td>
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</tbody>
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Note the cost for preparing the course and presentation of the course costs will be covered under the applicants’ normal teaching load in spring. This has been agreed upon by the Department Head.

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<td>Infrastructure needs*</td>
<td>$12000 (max)</td>
<td>Discounted mat.</td>
<td>Coring of existing concrete structure for water and electrical line $ 500</td>
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<td></td>
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<td>Solar water panels, pump, controls, and mounting system $ 3500</td>
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<td></td>
<td>Additional costs for floor mounted tubing system and gypcrete covering $7000</td>
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<td>Monitoring system $1000</td>
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