Service-Learning in Action: The PerUML Project

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Outline

1. Introduction

2. The Peru Project

3. An Interesting Challenge

4. Summary, reflections, conclusions
Vita

• Born and grown in Peru
• 2000 Bach. Universidad Nacional de Ingenieria
• Professional experience - energy business:
  • Energy affairs consultancy
  • Ministry of Energy and Mines
• 2001 came to UMASS Lowell
  • Member Peru Project this talk
  • 2003 Masters Energy Engineering – Solar
• 2003 – now PhD candidate U of MN

Focus: Numerical Modeling
Service Learning

“Integration of academic subject matter formally with service”

Challenges:

• Achieve academic objectives
• Meet real community needs
• Add no extra courses or material to curriculum

Goal:

More humanistic, global students, engaged in life-long learning
Story: Peru Project

• 1997: Undergraduates from UML approach then chaplain, Fr. Paul Soper for international service experience and travel to Peru, talk to villagers
• Fr. Paul approaches engineering school, Prof. John Duffy gets engaged with the idea
• Summer 1998: first students install PV systems in Peru

Thirteen trips later: +60 volunteers, +50 systems installed in eighteen villages for lights for schools, town halls, vaccine fridges, transceiver radios, nebulizers, laptops for medical clinics, water purification systems, aquaculture, and more ...

http://energy.caeds.eng.uml.edu
Peru Project

• Systems to help the development:
  
  health, energy, education, economy

• Requirement: Sustainable (good for environment, local materials, local operation/maintenance → community need to be engaged)

• Renewable energies ideal

Trips:

• Twice a year, ~two weeks/trip
• Limited money, equipment, knowledge, time
  
  → need to work hard with local community
Peru - Geography

http://www.weather.com/maps/maptype/satelliteworld/westernhemispheroglobalsallete_large_animated.html
Peru: A Country to Love...

- Machu Picchu
- Inca culture
- Rainforest
- Geography
- Food, dance
- Nice people

Peru Project
On the first trip …

The road
Malvas: Balcony to the Pacific
Solar panels on clinic roof
Installation of panels

road ~4 hours appart
Solar system: Lights and vaccine refrigeration
Prototype vaccine refrigerator
Water pasteurizer
Pasteurizer fabrication
Micro-hydro for battery charging

Irrigation channel

Hydro house
Micro-hydro for Malvas

Knowledge transfer
Micro-hydro for San Miguel

a condor?
Water source: irrigation channel
turbine
water in
circuits
First city light in San Miguel
Water Purification System for Quian

- Town and water supply lost by 1998 “Del Nino” phenomenon
- Only source of water: irrigation channel
- Small town → no priority for regional government

Plan:
- Bring water from irrigation channel (1.5 km away) → install pipe
- Purify it (UV light + filters) → needs energy
- Distribute it to town → need reservoir + pressure → energy
Water quality testing
Water purification building
irrigation water in

pure water out
from water source
to water purification building
Drinking water !!!
To another valley ...
No better way to travel ...
Nurses in action ...

the first light in town
Finally: lights & radio
For them ...
Water Purification System for Raypa

• Quian’s neighbor
• Similarly: town and water supply lost by 1998 “Del Nino” phenomenon
• Small, remote town → no priority for regional government

Plan:
• Bring water from river (300 m away) → pipes
• Pump water to purification station (sand filters) → needs energy
• Distribute it to town → reservoir + pressure → energy
Water source: river
Solar water pumping
Filtration system

local materials
Waiting for more work ...
The outcome ...

school
Other Systems

**Economic development:**
- Trout aquaculture
- Crayfish aquaculture

**Health:**
- Nebulizers
- Orthopedic prostheses
- Medical equipment for clinics

**Education:**
- lights & laptops for schools
- Solar energy training

**Energy:**
- Public lights
- Portable solar lanterns

And many more in progress …
An Interesting Challenge

Analogy: The cheesecake problem
• How to deliver a cheesecake if you have to walk for ~3 days through a ~rough trekking trail (no electricity)?

What if … instead of cheesecake, vaccines?
– vaccination campaigns

Current solution: (WHO)
Thermos + ice (from where?)
Our Answer:

Portable, standalone vaccine refrigerator

- Keep vaccine for ~4 days within 2 to 8 °C
- A person to carry it (i.e. in a backpack)
- Standalone → does not need external energy
Refrigerator Model

- **Inputs:** ambient temperature ($T_a$) and solar radiation ($G$)
- **Outputs:** water temperature ($T_w$), LHTES solid fraction ($f_s$), battery’s charge percentage ($f_{ch}$)
Simulation of Phase Change Container

Temperature in container holding vaccines

(night)
Testing Prototype System

heat sink
fan
thermocouples
data logger
TE controller
Service Learning from personal experience:

• Very challenging and stimulating
• Amazing learning experience
  • academically
  • personally
• Extremely rewarding

➢ Service learning adequate for **every student**
➢ Good for **everyone**
➢ Augsburg’s Center for Service, Work, and Learning
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«ENTRAR PARA APRENDER Y SALIR PARA SERVIR»