Request for Funding of Project Proposal

Application Form

Title of Project:
Engineering Museum Exhibits at the Interface of Science and Arts for Local Communities: “Experiential Landscapes”

Faculty Advisor: _Katherine Chen_     Department: __MATE__________
Faculty Advisor email: _kcchen@calpoly.edu_       Telephone: __756-6634_______

Anticipated Start Date: __9/12_______________
Anticipated End Date: __6/12_______________

Student Team Members & Departments:
MATE, ME, ARCH (architecture), CD (child development)
(students yet to be identified) _____________________________________________

Total Funds Requested ($):  $2,500_____________________

Signature of Faculty Advisor: _ Katherine Chen ______ Date: __4/16/12________
Engineering Museum Exhibits at the Interface of Science and Arts for Local Communities: “Experiential Landscapes”

We propose a collaboration among Cal Poly students and faculty from different disciplines (MATE, ME, ARCH, and CD) in which we will design, build and evaluate museum exhibits that feature opportunities for STEM (science, technology, engineering, and mathematics) learning. The exhibits will constitute an artistic, fun, immersive, and interactive STEM learning experience for the local community.

1. Statement of Work

The National Academy of Engineering (NAE) presents a strong message about the importance of engineering to our national security, economy, and quality of life, and recognizes that *how* the message gets delivered can have a strong impact on *who* will become our future engineers.¹ In addition, the need for more science, technology, engineering and math (STEM) competency for the general public routinely infiltrates various news articles, and is the subject of many national reports.²

Despite efforts to recruit more students to study STEM disciplines, the numbers still remain low, and the significant gender and ethnic gaps are disquieting. If more diverse backgrounds and approaches are required for innovative problem solving, then we need to do a better job at engaging people to learn STEM concepts and to inspire younger children to become future scientists and engineers.

As a means to make STEM more accessible and exciting, informal learning settings (i.e., outside of the formal classroom), such as museums, libraries, and after-school programs, are increasingly becoming important STEM education venues.³ Not surprising, *the solution for greater STEM literacy involves including non-STEM professionals in an effort to enact innovative informal educational strategies.* Thus, we are proposing an interdisciplinary project at Cal Poly to help communicate and promote STEM through innovative museum exhibits for our local community.

If funded, we intend to design, build, and evaluate a full-scale STEM-related exhibit to serve as a prototype for future projects, as well as develop a model for interdisciplinary, project-based learning. In a current course, UNIV 424, an interdisciplinary team of students and faculty works to generate conceptual STEM-related exhibit designs. Time and budget constraints, however, prevent the realization of these designs into functional prototypes. A robust prototype is needed for full-scale testing (engineering specifications) and evaluation (learning objectives) to pursue further funding.

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¹ Changing the Conversation, http://www.engineeringmessages.org/
² Rising above the Gathering Storm, http://www.nap.edu/catalog.php?record_id=11463
for other related exhibits. In addition, development of a prototype will demonstrate that the infrastructure of an interdisciplinary student and faculty team can produce innovative informal learning exhibits (which is a necessary component for funding agencies).

This proposal focuses on the development of an outdoor exhibit that covertly provides STEM learning opportunities while also serving as an artistic and functional structure. An “Experiential Landscape” composed of different materials in different layers or juxtapositions will involve a variety of forms (e.g., ground, steps, bench, tunnel) and provide multiple functions to support varied learning experiences for a range of potential users. For example, young children may crawl and climb over the structural elements while comparing the tactile experiences offered by different materials (e.g., smooth, cold, fuzzy, rough, etc.). Older children and adults may enjoy resting on the landscape as they read and discuss the accompanying exhibit signage that reveals the origin of those materials, their uses in cultures, and their potential for recycling or reuse. Different layers of the structure might illustrate layers of geology, the water cycle, or other scientific phenomena. Interactive elements embedded in the landscape will allow users to explore such concepts as biodegradability or erosion. Initial sketches of a possible rendition and other inspirations can be found in the Appendix.

Considerable interest in this exhibit has been expressed by a local non-profit organization, the Exploration Station museum in Grover Beach. They have outdoor space that they would like to develop, and as an additional innovative solution, initial brainstorming has considered using the Experiential Landscape to connect to the park across the street in a visual, physical, and interactive manner. Additional linkages could be made with the Exploration Station’s Electronic Waste program.

In order to successfully see this project through from design to development to evaluation, an interdisciplinary team is vital. Expertise from different fields and a variety of skills are needed, especially since the goal of the project is to reveal how different disciplines intertwine. By the nature of the project, the interdisciplinary team members will learn from each other: non-STEM students will learn basic principles to be conveyed and actually help with the communication of the learning goals for intended audiences, while STEM majors learn more about art, architecture, and human psychology.

**Project Objectives:**
- Assemble an interdisciplinary team of students with diverse backgrounds and skill sets
- Design an artistic and interactive STEM-related exhibit (“Experiential Landscape”) to fit the needs of the Exploration Station museum
- Build and test full-scale prototype
- Evaluate the exhibit against design criteria and for learning objectives
- Develop revised designs for larger exhibit in order to be used for future funding opportunities
- Document interdisciplinary learning experiences through reflections, journals/blogs, interviews, and photos
- Write up results for educational journals and conferences that highlight interdisciplinary projects and informal science learning
2. *Faculty Advisor*

Katherine Chen, Materials Engineering, 756-6634, kcchen@calpoly.edu

3. *Project Team: Departments and Skill Sets*

The following departments will be represented through the associated faculty member. The faculty team has previously worked together in a limited capacity, and this interdisciplinary project would catalyze the promising brainstorming session into concrete realization.

The faculty will recruit students with the appropriate skill sets, as follows:

- Kathy Chen - Materials Engineering (materials selection, materials in society, informal science education)
- Robert Arens - Architecture (art & design, materials, fabrication, landscape architecture)
- John Chen - Mechanical Engineering (mechanical systems design, fabrication)
- Jennifer Jipson - Child Development (exhibit interactions, exhibit evaluation, children’s science learning)

The project would most likely take the form of a multidisciplinary engineering senior project, and the architecture and child development students would be involved through class projects. Specific expertise and skills of the students are essential to contribute to the overall project.

4. *Potential Non-profit Partners*

The Exploration Station in Grover Beach has already expressed enthusiastic interest in working with Cal Poly. However, at this stage, only design concepts have been discussed. This project proposal would involve actual fabrication and evaluation of an exhibit prototype.

Demonstration of the capabilities of the interdisciplinary Cal Poly team to create exhibits would enable future funding (such as the NSF Informal Science Education division, SLO Community Foundation, etc.), as well as other local non-profit partnerships (e.g., Avila Sea Life Center, SLO County Libraries).

5. *Resources Required and Dissemination*

The main resources required are the materials and supplies necessary to fabricate the exhibit. Machining can be done at the engineering and/or architecture shops. Existing contacts with professional exhibit developers will also be utilized.
The exhibit itself will be disseminated through public display at the Exploration Station (after the project is presented at the College of Engineering Expo). The learning experience by the interdisciplinary team will be presented at educational venues, such as the American Society for Engineering Education (ASEE) conference.

6. **Timeline & Milestones:**

The timeline for the project (Table I) follows the academic year schedule for engineering senior projects, but preparations and dissemination by the faculty would occur before and after the student project.

Table I. Timeline of project milestones

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7. **Budget justification**

The total budget requested is $2,500. The bulk of the budget ($1,750) is to go towards purchasing the materials and supplies to build the full-scale exhibit prototype. Special machining might be required to go outside of Cal Poly. A small amount of the budget ($750) is requested for travel and conference attendance. Field trips to museums such as the Exploratorium in San Francisco and the California Science Center in Los Angeles would be useful to examine current science exhibits and to talk to professional exhibit developers. Potential conferences include ASEE and the Association of Science-Technology Centers (ASTC).
Appendix – preliminary sketches and inspirations for “Experiential Landscape”