

Geology Club Education Outreach Project Proposal

Terrariums-in-the-Classroom

An effort to bring science education back into Bay Area elementary schools



Proposal author: Robert J. Sas, Jr.
Faculty sponsors: Mary Leech

January 17, 2008

Department of Geosciences
San Francisco State University

Table of Contents

Introduction..... 3

Problem statement..... 3

Outline of why science education is in trouble; recent education statistics 3

San Francisco Chronicle article detailing issue..... 4

Proposed Solution 8

Provide science lessons in schools 8

Focus efforts at the elementary level 8

Partner with other campus organizations (AMS, SEPAL, EcoClub, ...) 8

Train volunteers to teach..... 8

Provide equipment to teach..... 9

Project design: Terrariums-in-the-Classroom..... 9

Introduction..... 9

Materials and costs..... 9

Set-up 10

Maintenance 10

Curriculum 10

Funding 11

Seek private donations from philanthropists 11

Seek sponsorship from businesses 11

Fundraising activities..... 11

Benefit to students 11

Improve science education at the elementary level in Bay Area schools 11

Support for club activities 12

Considerations for student health 12

Suggested course of action 12

Appendix I: Resources for Teachers 12

Introduction

Recent education research shows that elementary school students are most at-risk of having insufficient study in science. While education funding continues to be cut in California, this is not the only reason that science education has suffered. Major contributing factors include: the focus on reading and math skills now outweighs the concern over teaching science and other subjects, teachers and classrooms are not prepared, and standardized testing for science in elementary school only occurs in fifth grade in California. These educational challenges have resulted in barriers that teachers cannot break on their own. Regardless of how the educational system needs to be reformed, teachers need the support of the greater academic and social community to provide education in science.

This project proposal outlines how the SFSU Geology Club can supplement science education in the classroom of select elementary schools. The project includes a year long curriculum for setting-up and maintaining a terrarium for students to use for experimentation and learning. Terrariums provide a looking-glass into the natural world in a controlled-classroom setting.

Problem statement

Outline of why science education is in trouble; recent education statistics

- Numerous recent statistics indicate that science education is in jeopardy in Bay Area schools, especially elementary
- Teachers don't have enough time to prepare
- Most of class time is spent on math and reading because those were lagging for so long
- Bay Area elementary school students are most at risk
 - 80% of elementary teachers said they spent less than 1 hour per week on science
 - Only 47% of 5th graders passed the California Standard's Test in science
 - 16% of elementary teachers said they spend no time on science at all
 - 41% of elementary teachers said they feel unprepared to teach science

San Francisco Chronicle article detailing issue

The article below provides a good synopsis of the recent findings

Science courses nearly extinct in elementary grades, study finds

Nanette Asimov, Chronicle Staff Writer

Thursday, October 25, 2007

The third-graders looked puzzled when asked what they liked best about science. No answer.

OK, then, next question: "What *is* science?" a visitor asked the children in a hallway at Bessie Carmichael Elementary School in San Francisco.

"Science is like art," said Manuel, 7, who let that cryptic response hang in the air as he ducked away.

He might have meant that both can open the heart to beauty. Or maybe he was saying that science, like art, is something students don't get much of these days in elementary school.

If it were the latter, a new survey of 923 Bay Area elementary school teachers would agree.

About 80 percent of those teachers said they spent less than an hour each week teaching science, according to researchers from the Lawrence Hall of Science at UC Berkeley and from WestEd, an education think tank based in San Francisco.

In contrast, a national study seven years ago found elementary school science instruction averaged more than two hours per week, said Rena Dorph, the lead researcher on the new study.

"It's alarming because it's a very short amount of time per week dedicated to a subject that's considered a core subject in schools," said Dorph, who is director of the Center for Research, Evaluation and Assessment at the Lawrence Hall of Science.

Understanding science helps children learn to think and solve problems while questioning the world around them, Dorph said.

There is also evidence that people who go into scientific fields generally learned to love science as children, she said.

And as a practical matter, colleges require applicants to have taken science in high school.

"And how are you going to understand high school science if you haven't had it before fifth grade?" Dorph asked.

Her research team - reviewing responses from more than 80 Bay Area school districts as well as the teachers - made other sobering findings about elementary science instruction in Bay Area schools:

-- About 16 percent of the elementary teachers said they spent no time on science at all. (Most taught at schools that had missed the reading and math benchmarks of No Child Left Behind and were trying to catch up.)

-- Most kindergarten to fifth-grade students typically had science instruction no more than twice a week.

-- Ten times as many teachers said they felt unprepared to teach science (41 percent) than felt unprepared to teach math (4 percent) or reading (4 percent).

-- Fewer than half of Bay Area fifth-graders (47 percent) scored at grade level or above on last spring's California Standards Test in science. (Only fifth-graders are tested in science at the elementary level.)

"The demands of No Child Left Behind have made it almost impossible to devote enough time to science," said Melinda Dart, a fourth-grade teacher at Wilson Elementary School in Daly City's Jefferson Elementary District.

Dart was not among the anonymous hundreds surveyed by the researchers. But she agrees with the findings.

Dart is planning a field trip to the Exploratorium in December and is preparing her students by teaching them about electricity and magnets. In one lesson, she had them rub balloons with various materials so they would see the effects of positive and negative charges.

But she has had time for only three 30-minute science lessons since the semester began.

"It's very rushed," she said. "In order to develop a scientific way of thinking, the thing you need most is time. And in our test-driven schools today, time for experimenting and exploring is what we have the least of."

In San Francisco, Principal Jeffrey Burgos of Bessie Carmichael Elementary agreed - but said teachers can find ways to be creative beyond the limited time already set aside for science.

"You don't have to be a rocket scientist to figure out that you can't get everything into one day," which is about five hours of instructional time, he said.

So you shoehorn it in, sneaking science into reading and math lessons.

Second-grade teacher Bernadette Ison is a master at that.

Her classroom at Bessie Carmichael is filled with children who are learning English and who come from lower-income families - just the kind of challenges that policymakers say is why basic reading and math should trump science and social studies.

"So we integrate science into our literacy," Ison said. "Our reading curriculum is called "Nature Walk," and we have a theme called "Animals."

On Friday, the students will take a nature walk around Stow Lake in Golden Gate Park. Afterward, they'll write an essay on what they saw and learned, Ison said.

This year, the California Board of Education has purchased new elementary science textbooks and materials that are just now reaching classrooms.

The reviews have been mixed. Some teachers said the materials were clearer than what they replaced, though they covered less ground.

Others said they were overwhelming. One teacher counted 1,199 pages in the teachers' edition science workbooks, as well as flip charts, four large boxes of materials, vocabulary and concept cards, CDs and DVDs.

Perhaps it's no wonder that teachers have little time to teach it all. They barely have time to learn it themselves.

The other day, the textbook company came to the Jefferson Elementary District in Daly City to show teachers how to use all the new stuff, said third-grade teacher Janet Harrison.

The textbook instructors stayed 90 minutes, Harrison said. And then they were gone.

Got science?

Some of a new study's findings about elementary school science instruction in Bay Area schools:

-- 80 percent of teachers say they spend less than an hour each week teaching science.

-- 16 percent of the elementary teachers say they teach no science at all.

-- Ten times as many teachers say they feel unprepared to teach science than feel unprepared to teach math or reading.

-- Fewer than half of Bay Area fifth-graders scored at grade level or above on last spring's California Standards Test in science.

To see the full report, visit www.lawrencehallofscience.org/rea/bayareastudy.

E-mail Nanette Asimov at nasimov@sfchronicle.com.

<http://sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/10/25/MNNKSVFOH.DTL>

This article appeared on page **A - 1** of the San Francisco Chronicle

Reprinted for educational purposes only

Proposed Solution

Provide science lessons in schools

The most direct way we can help improve science education is to teach students in the classroom. This will first require the support of teachers and their schools. Commonly, the reason that teachers spend too little time on science is that they don't feel prepared or equipped to teach the subject. Although finding instructional time for science can be difficult, teachers will work with us if we demonstrate our sincere dedication to this project. Teachers must also be dedicated to this project for it to work, so garnering their support is an important first task.

Focus efforts at the elementary level

Although all grade levels could benefit from education outreach, we should focus our efforts where they are needed most. Given the current state of science education at the elementary level and the potential for lasting positive impact, we should direct our efforts on third graders. Third grade is an ideal grade to attempt such an exercise. Students in the third grade are in the middle of their elementary education and are two years away from taking the California Standards Test in science.

Increasing students' knowledge of and desire to study science at this age is important for generating future interest in careers in science. Geoscience offers students the opportunity to understand how basic science works and to study material across many disciplines.

Partner with other campus organizations (AMS, SEPAL, EcoClub, ...)

Other campus organizations have obligations and desires to fulfill community service hours and would offer an excellent base for volunteers. In particular, organizations with a focus on our natural environment and education should be sought.

Train volunteers to teach

Volunteers are the crux of this entire project and cannot be accomplished without the efforts of many people from the university and broader community. Volunteers are certainly willing to help, but may not have all the knowledge or skills to effectively implement our proposed project. Training is necessary for several reasons:

1. This project will require much organization and collaboration
2. Teaching is not easy and not everyone is experienced
3. Science is not easy to teach
4. A prescribed curriculum needs to be followed

Volunteers will be needed for a variety of tasks including contacting teachers, potential sponsors, preparing materials, and teaching. The time commitment is up to the volunteer but 20 hours per person per semester is a suggested minimum. Meeting with students at the same school several times throughout the school year is the only way to effectively supplement a curriculum.

Provide equipment to teach

The three most anticipated opinions of teachers pertaining to classroom equipment are:

1. Not enough equipment
2. Not sure what equipment is available
3. Overwhelmed with equipment

All three of these conditions can be aided through the efforts of this project. A major goal of this project is to provide financial sponsorship for equipment and materials so teachers can focus on improving science instruction. When equipment is unavailable we can provide the class with the necessary equipment and teachers will also save on preparation time.

Project design: Terrariums-in-the-Classroom

Introduction

A terrarium in its basic form is a miniature greenhouse containing soil, plants, nutrients and water. Terrariums often house carnivorous plants, insects, benthics, amphibians, and crustaceans. Terrariums are commonly used in science curriculums at all levels to examine natural processes and organisms in a simulated, controlled habitat.

Materials and costs

Item per terrarium	Quantity per year	Cost
container for terrarium	1	\$60
soil	4 lbs.	\$10
plants	4 to 10	\$30 to \$100
seeds	1 packet	\$5
stones and sticks	6 pcs.	Free, if collected outdoors (legally)
leaf litter	10 pcs.	Free, if collected outdoors (legally)
spray bottle	1	\$3
gravel	2 lbs.	\$10
aquarium air pump	1	\$20
creatures		
insects	50 pcs.	\$5
crayfish	1 pc.	\$4
salamander	1 pc.	\$15
snail	1 pc.	\$3
Plant and animal nutrition	1 of each	\$60
Approximate total cost of single terrarium		\$300

Set-up

Preparing the materials is probably the most time consuming aspect of set-up for this project. Actually setting-up the apparatus takes less than an hour and is done as part of instruction.

Maintenance

Part of the educational process will include teaching students to maintain the terrarium and care for the plants and creatures. The terrarium is set up in such a way that students can perform maintenance easily with some supervision from the teacher. Maintenance is an opportune time for teachers to take a few minutes for science instruction.

Curriculum

Introduction

The goal of this project is to supplement a science curriculum for third graders and is not intended to be a complete or sufficient course-of-study. The curriculum provides students a hands-on, group activity that is fruitful ground for individual learning and self-reflection. Although our activities will mostly revolve around group work, relatively short exercises can be given weekly by the teachers. Since terrariums are intended to closely represent natural environments it is hoped that students will gain an understanding and concern for the environment.

Reading and math skills are emphasized in this curriculum in several ways. Teachers are asked to incorporate class readings that relate to the terrarium. Math skills can be applied in the form of temperature measurement, geometry of container, counting, measuring time,

Reading tasks

- Class readings can have an emphasis on nature and science
- Handouts have written descriptions of activity
- Suggested reading
 -

Writing tasks

- Recording observations; each student should maintain a journal about the project
- Periodic writing on what changes are occurring in terrarium
- Periodic writing of reflection essays pertaining to terrarium and science

Math tasks

- temperature measurement – measure temperature of terrarium daily and determine temperature changes over time
- geometry of container – discuss how geometry of container affects the water cycle in the container; compare and contrast various container types for making the terrarium
- counting – simple counting of the number of various items in the container; complex counting can be emphasized (e.g., if one of the organisms generates offspring then they can be counted off by twos).

- measuring time – multiple time scales can be looked at and measured: time of evaporation, organism movement, organism growth

Assessment

- Concept maps demonstrating relationships between soil, water, rocks, plants, and animals (Pre- and post-assessment)
- Observation journal and reflection essays

Possible lesson plans can be found at these websites:

- *Terrarium and aquarium lesson plan:*
<http://www.uen.org/Lessonplan/preview.cgi?LPid=618>
- *Carnivorous plants in the classroom:*
<http://dousta.umsl.edu/patrick/carnivory/index.html>
- *The classroom jungle:*
<http://www.edunetconnect.com/cat/rainf/terr.html>
- *Plants and the water cycle:*
<http://www.teachnet.com/lesson/science/terrariums043099.html>
- *Terrarium activity for water cycle:*
<http://www.lessonplanspage.com/ScienceMathLATheWaterCyclePlan34.htm>

Funding

Seek private donations from philanthropists

Private contributions could come from retired faculty, university endowments, and those who already donate to the university.

Seek sponsorship from businesses

Donations from businesses would be the primary financial support for this project. Initially, these donations would provide seed money to purchase materials and implement them in a classroom to test the project design. More funding can be secured while the “proof of concept” is conducted.

Fundraising activities

Seek funding from the Associated Students of SFSU.

Benefit to students

Improve science education at the elementary level in Bay Area schools

- A program such as this will hopefully inspire other campuses to get involved
- It is hoped that students will be inspired to build terrariums at home with their parents/guardians

Support for club activities

Corporate sponsorship would likely provide sufficient funding to help support club activities. Depending on how ambitious the club is, this could really add up. Donors would be asked to decide what portion of their contribution can be used toward club activities besides this proposed project.

Considerations for student health

- Allergies to plants and animals
- Water and electricity in close proximity
- Psychological affect of organism death

Suggested course of action

1. Discuss and vote with geology club
2. Gain support from faculty and staff
3. Gain support from community centers
4. Department email and wall posters to gain interest
5. Locate and interview interested teachers and schools-in-need
6. Selecting the first teacher and students
 - a. Provide applications to interested teachers
 - b. Establish a selection criteria
 - c. Select 3 schools to visit and decide which one best exemplifies the selection criteria
7. Design lesson plans
8. Seek funding from businesses
9. Locate, purchase, and organize materials
10. Implement in classroom

Appendix I: Resources for Teachers

- *American Association for the Advancement of Science*
<http://www.aaas.org/programs/education/>
- *The Erosion of Science Education*
<http://www.sfgate.com/cgi-bin/article.cgi?file=/chronicle/archive/2004/07/22/EDG5R7QQ371.DTL>