



Abstract

St. Mary's University (StMU), a private Catholic and Marianist Liberal Arts Institution located in San Antonio, Texas has been recognized for its emphasis on service and educational outreach. The StMU campus is located in a predominantly Hispanic, low income community, and represents a "Gateway" for elementary students to receive hands-on experience in earth science.

Over 300 elementary students engaged in a Geologic adventure thru our Earth Science Museum. The search in the museum included dinosaur fossils, Trilobites, and Earth elements. The Edwards Aquifer, the main source of San Antonio's drinking water was explained using a physical model to show how water can infiltrate the ground and how wells affect water table levels and ground conditions. The success of the "Fiesta of Physics Fair and Earth Science Extravaganza" was measured by the in depth questions asked by the children, enthusiasm of wanting to touch all the rock samples, and expressing the desire to want to come back next year. Additional exhibits are also planned to take to area schools.

Introduction

StMU is located in a predominantly Hispanic, low-income neighborhood on the Westside of San Antonio with <3 percent of the population have achieved an undergraduate degree (Nivin et al., 2008; Malagamba, 2010). A core part of the Marianist heritage at StMU is the idea of community service and life-long education. In fulfilling this mission, the university has a long history of outreach, bringing students and residents to campus for a variety of different free open programs (StMU, 2006).

In 2003, the faculty and students in what was then the Department of Physics initiated an outreach program called, "The Fiesta of Physics". This became a highly successful program, with requests to expand the program from the San Antonio and Edgewood Independent School Districts that border the StMU campus. The program now reaches about 1,100 elementary, middle and high school students, parents and teachers each year. In January of 2011, the program coordinator, Dr. Richard Cardenas received a Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring.

In 2006, the Department of Physics was combined with the Department of Earth Sciences; at the same time teachers began requesting that environmental and earth science activities be included in the Fiesta of Physics. In Fall 2011, StMU received approval to start a new Environmental Science program. A natural extension of this program was to develop the requested earth science experiments for area school children. As a result, the "Earth Science Extravaganza" was added to the existing program. The experiments performed in the study of Geology include identifying the rock cycle with the actual Igneous, Sedimentary, and Metamorphic rocks. Rocks in the labs underwent hardness tests, acid tests, and Magnetite Ore hunting.

Development Of Earth Science Hands-on Exhibits For Science, Technology, Engineering, and Mathematics (STEM) Enrichment At The Elementary Level

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Activities and Outcomes

Earth Science has been an area of study at St. Mary's since 1947 (Doyle, 2002), and the department has an extensive collection of materials such as minerals, rocks, fossils, and maps that can be used to demonstrate geologic concepts. This is perhaps best represented by the David Fitzgerald Earth Science Museum. The StMU students and faculty decided to focus on hands-on activities that provide a more effective means of instilling an appreciation of science in general, and Earth Science in particular (Hochella, 2006; Mogk, 2006; Perkins, 2006). The hands-on method will:

- Reinforce previously-learned scientific concepts and principles. The students learn by using the materials, which can also reduce off-task behavior issues (Burleson, 2012).
- Use active learning strategies to realign complex thought processes
- Encourage retention of information, which motivates a student's curiosity to explore Earth Science

Mineral Identification

Students explored mineral properties through mineral identification

- **Hardness.** Students used fragments of calcite to write messages on chalkboards. They also examined soft minerals like talc and harder minerals like quartz using glass plates.
- **Reaction.** Students tested for reactivity using dilute acid on Calcite and Magnetite. Then they examined different rocks types (limestone, sandstone, chalk) to see if calcite was present
- **Color and Streak.** The potentially wide variation in mineral color was demonstrated using varieties of quartz. Streak tests showed that powdered minerals may be very different from the color of the mineral. Fluorescent minerals were examined using a UV light source
- **Smell and Taste.** High school students used their other senses such as smell to identify sulfide minerals like Sphalerite, and taste to identify salts like Halite and Sylvite

Interactive Rock Cycle:

A rotating "rock cycle" with physical samples of Igneous, Sedimentary, and Metamorphic rocks allowed the students to examine the individual steps and processes of the rock cycle. The various rocks were identified by their formation processes and physical properties.



Mineral Identification – Hardness Testing

Water Resources: The Edwards Aquifer in San Antonio has a large concern for our community. The Edwards Aquifer is our main source of ground water. The activity demonstrated how permeable rocks work in filtration of our ground water being cleaned naturally. Students need to understand how we pump our ground water and how contamination could be a disastrous situation for our community.



Magnetite Ore Hunt/Rock Cycle



Fossils – Dinosaur Footprints



Aquifer Model and Water Resources

Magnetite Ore Hunt: To give students an appreciation of both mineral properties and the idea of the Earth as a source of our natural resources, each child used magnets on strings to prospect for magnetite. The identification of mineral properties with the use of magnets, glass, or diluted acid solutions are the first glance of ways to identify the Earth's physical structures.



Scavenger Hunt - Earth Science Museum

Fossils: Dinosaurs are always a favorite with children. Our dinosaur exhibit explored the locations and time periods of extinct dinosaurs. The Mammoth teeth sample put the size of the mammal into perspective. The students were shown safety equipment such as, hard hats to show that research can be dangerous and protection is serious.

Scavenger hunt to use the skills learned in the individual exercises

Summary and Future Plans

Introducing local students to a university setting at an early age is critical, especially when there may not be a strong background with higher education (Nivin et al., 2008). A group of elementary school gifted/talented students from the Northside Independent School District in San Antonio were thrilled to interact with real university students and faculty. The hands-on mentoring fostered student interest in Earth Science studies (Burleson, 2012).

- The hands-on teaching aids were successful, with positive feedback from students and teachers

- The project was low-cost

- The demonstrations are portable and can be taken off-site from school to school

- Additional, more interactive activities are being designed to illustrate different geological concepts

One current limitation to the Extravaganza is a lack of objective measures of understanding and longer term retention. Future efforts may focus on developing both quantitative and qualitative assessment methods, such as

- Early discussions with participating teachers to establish baseline levels of Earth Science understanding
- Follow-up to allow students to apply specific learned.
 - For example, the Earth Science Museum scavenger hunt allowed the students to immediately apply mineral/fossil identification skills
- Longer-term studies to follow a limited number of students to identify potential effects on educational outcomes
 - An example of cognitive retention may be higher science scores on the new State of Texas Assessments of Academic Readiness (**STAAR**) test, scheduled to begin in Spring 2012

The success of the Fiesta of Physics and Earth Science Extravaganza has more schools showing interest in participating. The ongoing budget cuts in education limits field trip opportunities, and science materials that can be purchased to use in the classroom. With outreach programs students will have access to science instruction that will be real life, relative, and inspiring for students who wish to pursue a science career. (Burleson 2012).

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For more information on St. Mary's University and the Fiesta of Physics/Earth Sciences Extravaganza, scan the QR code with your smart phone



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