

SySTEMIC REFORM IN SCIENCE (SyRIS)

A Project to Revitalize and Improve the Quality of Undergraduate SMET Teaching and Enhance Student Learning

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ABSTRACT

Systemic Reform In Science (SyRIS) is a project to improve student outcomes in science through changes in pedagogy. SMET faculty form collaborative teams to develop and pilot interdisciplinary science modules for entry-level college science courses. Using active learning strategies and critical thinking, the modules convey to students the links between the sciences.

INTRODUCTION

The didactic teaching approach remains a fixture in many introductory science classes despite numerous studies showing students retain little of the information taught. The approach neither fosters an interest in science nor promotes the critical thinking skills science demands.

In addition, the diverse learning styles of today's science, math, engineering, and technology (SMET) students have lead to difficulties in their ability to transfer knowledge from one course or solution to another.

To address the problems of pedagogy and learning, the Maricopa Community Colleges were awarded a National Science Foundation grant to reform teaching and learning in entry-level science courses.



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THE SYRIS PROJECT

Systemic Reform In Science (SyRIS) is a two-year, district-wide project at the Maricopa Community Colleges to improve student outcomes in science by using an interdisciplinary approach that promotes active learning and critical thinking in the science classroom and laboratory.

- The major goals of SyRIS are to:
- Design, develop, and field-test **interdisciplinary science modules** based on current curriculum content in 100 (entry) level science courses.
 - Engage SyRIS and other SMET faculty in workshops and courses that provide them with the tools to advance their teaching and ultimately assure student success.



CURRICULUM & PEDAGOGY PLAN

To bring about a pedagogical change, the interdisciplinary science modules are developed in the following way.

- In the fall semesters:**
- Each participating college forms a collaborative team, consisting of a SMET faculty peer mentor and 2-4 interdisciplinary SMET faculty.
 - The team identifies a course topic that spans the interdisciplinary disciplines. They then design and develop the topic as an interdisciplinary science module.
- In the spring semesters:**
- The team field-tests the interdisciplinary science module at their college and carries out an assessment of that module.



THE INTERDISCIPLINARY MODULES: 2000-2001

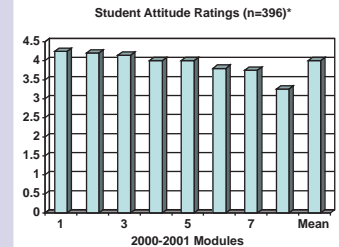
- Catch the Waves** – A module connecting the physics, math, and biology concepts involved with sound, water, and light waves.
- Water Pollution and Treatment** – A module incorporating geological, physical, chemical, and math concepts in the evaluation of water purity and water treatment.
- Energy and Thermodynamics** – A hands-on module designed to give biology, chemistry, and physics students concrete experiences related to the concepts of thermodynamics.
- Global Warming** – A module designed so students gain awareness and better understanding of global warming and what they can do about it.
- Cells As Digital Images** – An Investigation – A biology and math module to investigate specific relationships between normal and abnormal blood cells.
- UV Radiation and Effects of Sunblocks** – The module relates the central concepts of radiation, mutation and cancer formation, protective chemistry, and modeling of data sets.
- The Problem with Pesticides** – A hands-on chemistry, geology, and biology module involving pollution, chemicals in the environment, and pesticide use.
- Don't Drink the Water** – A problem-based learning module that examines the quality of water.



THE INTERDISCIPLINARY MODULES: 2001-2002

- The Power of the Exponent: A Case Study** – A module exploring the concept of exponents in biology, chemistry, physics, and math.
- A Treasure Lost: Was the Site Viable for a Copper Mine?** – A problem-based learning module looking at the interdisciplinary impacts of mining.
- Breathless: A Disease Investigation** – A problem-based module dealing with a disease-outbreak originating on an airline flight.
- Evolution: The Only Constant is Change** – This module uses evolution as a vehicle to demonstrate scientific synergy to introductory level students.
- Enzyme Activity** – A module using biology and chemistry concepts with programming parameters to create a computer model for enzyme activity.
- Earth Fissures: Arizona's Crack Problem** – This field-based module explores the interactions between biology, chemistry, geology, and engineering with regard to earth fissures.
- Aerobic Fitness: Assessing Cardiovascular Fitness** – A module that addresses aerobic respiration through biology, chemistry, and exercise physiology.
- Science of Survival: Thermal Exchange Across Surfaces** – Biology, chemistry, physics, and math concepts are used in this module to investigate thermal exchange across surfaces and its effect on living organisms.
- Air Pollution and Acid Rain** – This module examines the causes of air pollution and acid rain and their effects on the environment.

ASSESSMENT



Instructor Attitude Ratings (n=17)

Item	Description	Mean Rating*
1	The material is worthwhile for the students to learn	4.76
2	The module was well organized	4.38
3	The module outcomes were clearly stated	4.18
4	I received adequate directions for teaching the module	4.24
5	The instructor notes were easy to use	3.82
6	The individual practice helped students learn	4.43
7	The group activities were effective in helping students learn	4.53
8	The materials were interesting and appealing	4.59
9	I would use this module again	4.53
10	I liked this module	4.59
11	I would recommend this module to other instructors	4.41
Overall mean		4.41

* Based on a Likert-type item survey of field-test instructors

CONCLUSION

We believe our efforts to start the process of instructional reform will translate into a better, more applied curriculum that will foster a keener interest in, and understanding of, science that promotes the thinking skills science, and the community in general, requires.

For more information about the SyRIS Project, contact:

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