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Taking physics, astronomy and engineering to Native American K-12 schools.

Presented by Barry L. Lutz
Associate Director, Arizona Space Grant Consortium
Director, Northern Arizona University Space Grant Program
Sponsors

- A continuing project of the Arizona Space Grant Consortium at Northern Arizona University under the sponsorship of

Northern Arizona University
Department of Physics and Astronomy

and

Raytheon

a corporate sponsor and Space Grant Affiliate

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The American Indian Mobile Education Resources (AIMER) project began in 1995 with NAU Space Grant securing:

- a used 19-foot travel trailer donated by the NAU Foundation,
History

Original 19-foot AIMER Mobile Computer Laboratory
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- a $30,000 computer grant from Intel to outfit the trailer with 5 Pentium class computers, and
- personnel and operations support from the NAU Space Grant.
History

Robert L. Swift, MS
Adjunct Professor
NAU/Space Grant Science Outreach Coordinator
Concept

- Provide a technology-based mobile facility for use in Native American schools in rural Arizona to teach concepts of physics, astronomy and engineering and

- Offer community outreach programs for the parents and families of Native American students in rural Arizona.
AIMER delivers education and community outreach experiences in four broad areas:

1. Astronomical simulations using Dance of the Planets and Starry Night,
2. Image processing using Scion Image and VistaPro,
3. Robots and programming using Mindstorms, RobotLab, Rascal and Pbasic, and
4. Evening telescope shows with the option of CCD imagery.
Astronomical Simulations Software

- Dance of the Planets
  - Excellent orbit simulations
  - Helps students identify object seen in telescopes
  - Predicts what will be visible, when and where
  - Encourages and stimulates critical thinking
  - Students are led to a personal synthesis of the laws of Kepler and Newton and an understanding of why comets, planets, moons, space probes, etc. behave as they do

- Starry Night
  - Does primarily the same thing as Dance of the Planets, but is not as rigorous and is used with younger students
**Image Processing Software**

- Scion Image
  - Provides an introduction to imaging processing concepts and techniques preparing students for image manipulation

- VistaPro
  - Leads students through terrain modeling starting with local digital elevation maps and proceeds to processing Mars data and terra-forming
Robots and Programming Software

• MindStorms (for PCs) and RoboLab (for Macs)
  – Introduction to programming a Lego Rover

  – Graphical interface, simple to use
Robots and Programming Software

- Rascal
  - Programs a mechanical arm
  - Semigraphical, and easy to program
Robots and programming Software

- **Pbasic**
  - Variation on BASIC
  - Used with Arobot rovers
  - Implementation in the near future
Community Outreach

• Computerized 8-inch Meade telescope
  – Purchase by NAU Space Grant made possible by Raytheon
  – Allows rapid switching between objects of interest

• Donated manually operated 8-inch Dobsonians
  – Primarily used by students for observing experience
  – Introduces students to concepts of Right Ascension and Declination and how to find objects in the sky

• CCD camera attachment for Meade
  – Primarily used by host teachers who are also amateur astronomers
  – Future integration into community night events
How Does it Work?

- AIMER is best suited for grades 7 and up
- Schools or teachers can request a visit by AIMER during the school year, which is provided to them at no charge
- Teachers are taught how to use the programs to supplement the Science Outreach Coordinator
- Number of visits to schools is limited by time, personnel and funding, so only about 10 trips can be taken per year, but one trip can visit two or more schools can be served during one trip
How Does it Work?

• AIMER resides at a school for several days at a time, long enough to give each student an introductory half hour or 45 minute session with Dance with the Planets or Starry Night

• On follow-up sessions, students can investigate the astronomical programs in more depth or advance to either image processing or robot programming modules
How Does it Work?

Students at work with Astronomy Programs

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Where Do We Go?

- The major visits are to the Navajo and Hopi Reservations
Where Do We GO?

•But not all…

NAU/NASA Space Grant
Telescope and AIMER Sites
Updated 10-1-01

Black Mesa Community School
Cave Creek High School (North Phoenix)
Cove Day School
Chilchinbeto Boarding School
Chinle High School
Chinle Middle School
Cottonwood Day School
Crown Point Elementary School
Dennehotso Boarding School
D’zil Libei (Cameron) Community School
Gallup Academy High School
Ganado High School
Ganado Middle School
Ganado Elementary School
Ganado Continuation School
Ganado Middle School
Grand Canyon High School
Greasewood Boarding School
Ha:San Academy (Tucson)
Hopi (Keams Canyon) Jr/Sr High School
Hotevilla-Bacavi Community School
Hunters Point Boarding School
Kaibeto Boarding School
Kayenta Middle School
Leupp School
Lukachukai Boarding School
Many Farms Boarding School
Maxwell Middle School (Tucson)
Moencopi Day School
Monument Valley (Kayenta) High School
Navajo Mountain Boarding School
Nazlini Boarding School
Patagonia Union High School
Pine Springs Boarding School
Polacca Day School
Red Mesa High School
Round Rock Day School
Second Mesa Day School
Shonto Boarding School
South Beaver School
St. Michaels Academy
T’iis Na’zbas Boarding School
Tonalea Boarding School
Tsaile Elementary School
Tuba City Boarding School
Utterback Middle School (Tucson)
Weitzel Elementary School
Wide Ruins Community School

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Specifics on Visits

- About 10 reservation school visits per school year
- About 2000 students per school year
- Each trip averages 2 to 4 days
- Cost per trip: ~$ 2,000.
Lessons Learned and Outcomes

- Teachers do increase their depth of understanding of science
- Teachers are motivated to use our teaching methods throughout the year…but
- Teacher and administrator turnover is high on the reservations…which means
  - Continual teacher training in these areas
  - Substitutes for long-term teachers to learn more is a major problem for the schools
Lessons Learned and Outcomes

• Evening community telescope shows often get large all-age audiences
• Starry Night is a good supplement to these shows and for parent demonstrations
• In Navajoland, star-gazing season begins with the first frost
• Adult participants often provide Navajo names and stories of constellations, along with their significance
Lessons Learned and Outcomes

- In some schools students are encouraged to develop booklets of sky lore, both traditional and western.
- Some schools use our community shows to get more parents to PTO meetings.
- Jupiter and Saturn are the most popular objects for viewing.
- Viewing the Moon is sometimes permissible, but watching either lunar or solar eclipses is often taboo.
AIMER is also used in Flagstaff area Science Activities such as the annual Festival of Science.

AIMER student instructing future engineer in robot programming.
Other Activities

AIMER student teaching the finer points of robots

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What’s Next

• The old trailer has reached its last leg. A new one is being purchased to which the classroom will be transferred by the end of this year.

• The purchase of the new trailer and implementing it has an estimated cost of $25,000 to $30,000.

• Raytheon has generously underwritten $10,000 toward the new facility, and the College of Arts and Sciences and the Department of Physics and Astronomy have each contributed $3,000 this year, and other donations have added an additional $4,000.
What’s Next

• We are currently seeking the remaining $5,000 to $10,000 to complete the facility and have to have it up and running by the end of this year.

• We are investigating partnerships with other NAU offices to extend AIMER to other reservation schools and jointly seeking funding from federal agencies to cover the cost of an enhanced program.
What’s Next

• So if you know of anyone who would like to help these kids:

• Please let us know!!
The End

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