The goal of the Astrobiology in the Secondary Classroom (ASC) curriculum development project is to establish a successful model for increasing the use of authentic scientific data to connect non-mainstream high school students to the real world of science and scientists. The web-based ASC modules have been developed by Tennessee State University in partnership with the Minority Institution Astrobiology Collaborative and the NASA Astrobiology Institute to create a high-quality curriculum available for free via the Internet. Our six curriculum field-testing sites are in public schools or after-school programs in which 90% or more of the participants are African American, Hispanic, and/or Native American. The curriculum has been field-tested at six sites: two after-school programs including Tennessee State University and the Consortium of Paiute Shoshone Indian Reservations in Owens Valley, California, and high schools in four school districts around the country. Three of the six sites are designated as NASA Science, Engineering, Mathematics and Aerospace Academies (SEMAA). During this last year of the project we will continue incorporating teacher feedback into the ASC curriculum, analyzing collected student and teacher data, and preparing the curriculum for the NASA review process to become an official NASA educational product.

Overview

The Astrobiology in the Secondary Classroom project consists of a research-based curriculum framework that is being developed in three different minority communities. Addressing the ASC research questions, helping teachers with implementation, and examining curriculum-teacher-student interactions lead us to the creation of a diagram of factors influencing teacher implementation of the ASC curriculum and data of Native, African-American and Latino students.

Unique Aspects of the ASC project

There are many unique aspects to the ASC Curriculum Development Project:
- The development process has occurred mostly in diverse minority communities
- Three different communities in six different geographic locations contributed to its development
- The curriculum will potentially be adopted by NASA & used within the national SEMAA network
- The activities were developed in the spirit of an interdisciplinary science using actual scientific data

Student Participants - Year 3

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<th>Variable</th>
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Data Provided by Instructor (N=572):

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<td>Branchville, SC</td>
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</table>

Curriculum Modules & Activities

The modules under development are based on recent research-based strategies designed to diminish achievement gaps and increase the participation of diverse students in STEM activities.

Module 1: What is Astrobiology?
- Sample Activity: Four Corners: Where are you?

Module 2: Astrobiology & the Search for Life in the Universe
- Sample Activity: Conway’s Game of Life

Module 3: Extreme Organisms
- Sample Activity: Geomicrobiology Data Analysis

Module 4: Astrobiology and Planetesimals
- Sample Activity: Simulating Mars Exploration via Rovers

Module 5: Spectroscopy and its Applications
- Sample Activity: Taking a Reflectance Spectrum

Module 6: Ethics of Astrobiology
- Sample Activity: Class Debate on Sample Return

Factors Influencing Teacher Implementation of ASC Curriculum

Research Questions

Does the Astrobiology in the Secondary Classroom Curriculum: (1) Have a coherent content framework that is aligned with research-based pedagogy for diverse groups of students? (2) Support student understanding of core STEM content and basic STEM concepts in formal educational settings (high school classrooms) as well as in informal educational settings after school? (3) Increase the science literacy of diverse groups of students? (4) Contain activities and professional development opportunities that allow teachers to effectively educate diverse groups of students? (5) Infuse methodologies enabled by “cyber-infrastructure” that expands teachers and students access to real-world scientific data? (6) Provide unique questions that increase student interest in STEM areas? (7) Promote sustained collaborations between students, scientists, teachers, and universities?

Research-Based Curriculum Framework

Curriculum-Teacher-Student Interaction

Helping Teachers with Implementation

In addition to the iterative changes to the curriculum, visits were made to all of the six implementation sites over the three years to assist pilot teachers, gain feedback, and provide additional training and supplies. Each year, sites new to the project received a ‘traditional’ professional development workshop. Sites with a follow-up visit were involved in:
- Team teaching ASC lessons with ASC staff in the pilot teacher’s classroom
- Small group reflection and discussion sessions regarding implementation of the ASC curriculum
- Implementation-based training on technology and concepts related to astrobiology topics
- Assistance with materials, supplies, curriculum integration, and the teacher learning community

During the Next Year...

We will be finishing up curriculum modifications in order to produce a strong, research-oriented interdisciplinary curriculum that is geared towards diverse student audiences. We will continue to help pilot teachers with implementation through the relationships we have built over the first three years, and analyze our collected teacher and student data to answer our research questions.

References

- "Alignment to district & school goals along with expectations," L. Ariño de la Rubia, 2006.
- "Supporting the real world of science and scientists. The web-based ASC modules have been developed by Tennessee State University in partnership with the Minor..." L. Ariño de la Rubia, 2006.
- "The Backward Design of Wiggins & McTighe (1999), the standards proposed as a part of the CREDE Project that characterize the dynamics of learning in diverse cultures (Tharp, et al., 2003), and the backward design principles of Wiggins and McTighe (1998)." L. Ariño de la Rubia, 2006.
- "Differentiated instruction and assessment options are also incorporated to assist teachers in meeting the needs of students with varying abilities (Tomlinson & McTighe, 2006)." L. Ariño de la Rubia, 2006.
- "What is Astrobiology?" L. Ariño de la Rubia, 2006.
- "Diagram adapted from materials developed by Dr. Kate Donnelly of Williamson County Schools and used with permission. Also referenced: DeStefano, 2002, 2005; Guo, 2007; and Fernando, 2004.

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