

# THE ASTROBIOLOGY IN SECONDARY CLASSROOM (ASC) CURRICULUM DEVELOPMENT PROJECT: FOCUSING UPON DIVERSE STUDENTS AND TEACHERS IN THE PILOT TESTING PROCESS.

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**Introduction.** The Astrobiology in the Secondary Classroom (ASC) Curriculum is currently under development through collaboration with the Minority Institution Astrobiology Collaborative (MIAC), the NASA Astrobiology Institute (NAI), and curriculum developers from Tennessee State University. The focus of ASC is to address the unique learning issues present in the diverse classrooms found in both formal and informal educational settings. ASC modules incorporate research-based teaching strategies that diminish achievement gaps and increase participation of underrepresented groups in science, technology, engineering, and mathematics.

Scientists from Goddard Center for Astrobiology (GCA), the Carnegie Institute of Washington, and the Indiana-Princeton-Tennessee Astrobiology Initiative, have provided funding and scientific data to the developers during the initial design phases of ASC. The ASC curriculum is comprised of 6 modules that include hands-on science activities, computer simulations, and analysis of real NASA data sets. The final format of the curriculum will be available as a free web-based instructional package that provides middle and high school students with authentic science inquiry activities while pondering the "big questions" of life on Earth and beyond.

**Pilot Testing.** The curriculum is being pilot-tested at eight sites: two after-school programs including Tennessee State University and the Consortium of Paiute Shoshone Indian Reservations in Owens Valley, California, plus high schools in six school districts around the country. Three of the eight sites are designated as NASA Science, Engineering, Mathematics and Aerospace Academies (SEMAA). The instructional activities have been field-tested in classrooms with over 90% Native American, African American, or Latino/a students.

The ASC pilot teachers span the United States from coast to coast. During the first two years of the project teachers have been trained in a variety of environments from an urban school district in Miami to remote tribal schools. All pilot teachers work with students who face major learning challenges that include poverty, English as a second language, and schools with few resources. Nonetheless, the teachers are enthusiastic about the ASC curriculum and report that they are becoming better science teachers. The students have demonstrated increased skills and interests in STEM

areas. Both teachers and students are intrigued with the "big questions" of astrobiology. Scientists regard their participation as an opportunity for outreach to minority students who are vastly under-represented in STEM fields. As one teacher wrote on the end of year survey, *"I've learned a wealth of information as it relates to ASC. I've become intrigued myself with the possibility of life existing anywhere else other than Earth. This experience has afforded my students a great opportunity to be exposed to the wonderful curriculum that being established."*

**Program Evaluation.** Evaluation of the ASC curriculum includes web-based collaborations among teachers, scientists and curriculum developers to enhance the modules. Research data is currently being collected and analyzed as part of a three year pilot study funded by the National Science Foundation. The activities and resulting research is looking at a broad spectrum of variables including change in confidence levels of teachers in the use of research-based instructional strategies, their comfort level in new science content knowledge, and teacher perceptions of change in student academic behavior along with science achievement. In addition to teacher self-report surveys and interviews the project staff gathered student survey data on science interest and performance scores on end of module assessment questions. The intent of evaluating these areas through both teacher and students data is to measure the impact of the ASC curriculum on diverse groups of students using a variety of assessment instruments and work samples. The project staff uses this formative evaluation information to revise the ASC curriculum.

A variety of instruments are used to gather data on the ASC curriculum. Initial findings during year one and two of the grant were designed to determine the success of the ASC materials in meeting the goals of the grant. There are two main types of instruments employed: instruments geared towards teachers and instruments geared towards students. Teacher instruments included surveys completed on paper and mailed in, surveys deployed online, teacher lesson plan feedback, and teacher interviews.

In addition to formal assessments of student content knowledge and interest in areas of science, analysis of work samples of students have been valuable in assessing changes in student and teacher

thinking through the course of the two years of this pilot-testing project. Data about the community of learners were also obtained through analysis of electronic communication and collaboration with the teachers, students and scientists.

### Summary of Major Findings:

#### Part 1: Teachers

- Teacher self report data indicate that the ASC curriculum has a coherent framework that is aligned with research-based pedagogy for diverse students (qualitative data from structured interviews).
- Teachers reported that the ASC Curriculum had a major impact on student interest and performance
- The ASC curriculum contains activities and professional development opportunities that allow teachers to educate diverse groups of students. Teachers had a high degree of satisfaction with the professional development giving the ASC training a perfect rating of 4.0/4.0 on the end of session surveys.
- Feedback from teachers suggests that they were able to teach the ASC curriculum to their students and in so doing gained confidence in scientific knowledge and the use of instruments

#### Part 2: Students

- The ASC curriculum supported 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
- The ASC curriculum increased science literacy in diverse groups of students.
- The ASC curriculum provided unique questions that increased student interest in STEM areas

#### Part 3: Teacher Learning Community

- The ASC curriculum was created through collaboration among teachers, astrobiology research scientists, and universities.
- The Teacher Learning Community is supported through the collaboratory website
- The field testing process is extending the ASC collaboration to students. Students at pilot sites have met astrobiologists in person or virtually, learned about what research scientists do and are learning to analyze scientist provided real-world data sets.

For more information about the ASC Curriculum development program visit the website funded by the NASA Astrobiology Institute: <http://www.astroclassroom.org/>

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