ENGAGING STUDENTS IN RESEARCH – YOUNG ENGINEERS & SCIENTISTS (YES). D. C. Boice[1] , H. E. Asbell[2] and P. H. Reiff[3], [1]Southwest Research Institute, Space Science & Engineering Dept., 6220 Culebra Rd., San Antonio, TX 78238 USA, DBoice@swri.edu, [2]Jay High School, Science & Engineering Academy, 7611 Marbach Rd., San Antonio, TX, 78227 USA, [3]Rice University, Physics & Astronomy Dept., 6100 Main Str., Houston, TX 770005 USA.

Introduction: Young Engineers and Scientists (YES) [1-8] is a community partnership between Southwest Research Institute (SwRI), and local high schools in San Antonio, Texas (USA) during the past 16 years. The YES program provides talented high school juniors and seniors a bridge between classroom instruction and real world, research experiences in physical sciences (including space science) and engineering. YES consists of an intensive three-week summer workshop held at SwRI and a collegial mentorship where students complete individual research projects under the guidance of their professional mentors during the academic year.

Program Description: Talented high school juniors and seniors participate in real world, research experiences in physical sciences, information sciences, and engineering. YES consists of two parts: 1) An intensive three-week summer workshop held at SwRI where students experience the research environment first-hand; develop skills and acquire tools for solving scientific problems, attend mini-courses and seminars on electronics, C++ programming, the Internet, careers, science ethics, social impact of technology, and other topics; and select their individual research project with their mentor (SwRI staff member) to be completed during the academic year; and 2) a collegial mentorship where students complete individual research projects under the guidance of their mentors and teachers during the academic year and earn honors credit. At the end of the school year, students publicly present and display their work, acknowledging their accomplishments and spreading career awareness to other students and teachers. YES has been highly successful during the past sixteen years. All YES graduates have entered college, several work or have worked for SwRI, and three scientific publications have resulted. Student, teacher, and mentor evaluations have been very positive, indicating the effectiveness of YES on the students' academic preparation and choice of college majors.

Goals of the YES Program: The goals of YES are to increase the number of high school students, especially those from underrepresented groups, seeking careers in science and engineering and to enhance their success in entering the college and major of their choice. This is accomplished by 1) expanding career awareness, including information on "hot" career areas through seminars and laboratory tours by SwRI staff, and 2) allowing students to interact on a continuing basis with role models at SwRI in a real-world research environment.

Program Activities. Students spend the full workday at SwRI during the three-week, summer workshop and participate in mini-courses, seminars, tours of SwRI research facilities, and discussion groups. Many topics are covered including choosing a career, the library as a research tool, science ethics, social impact of technology, proposal preparation and the funding process, a college panel, SwRI staff interviews, finding college grants and scholarships, and the scientific publication process. Mini-courses are held for a week of half-day instruction and include an electronics laboratory, the Internet and constructing a WWW site (http://yesserver.space.swri.edu), problem solving and critical thinking, C++ computer programming, and instruction in using the Mathematica software package. The website topic for YES 2008 was NASA's Magnetospheric Multiscale Mission (MMS). These activities provide essential background information for the students to use in order to choose a topic of investigation for their year-long independent study project. This investigation culminates in a formal presentation in the spring in which the student presents a tangible product developed through the year under the guidance of their SwRI mentor and teachers.

Target Population: The YES Program has been held successfully for the past fifteen years and the population has ranged from 9 to 22 junior/senior high school students per year, depending on available funds. A total of 198 students have completed YES or are currently enrolled. Of these students, 72 (37%) are females and 111 (56%) are ethnic minorities, reflecting the local ethnic diversity, and 132 (67%) represent underserved groups. Students participating in YES 2007/2008, totaled 20, with 8 (40%) females, 10 (50%) ethnic minorities, and 13 (65%) underserved groups. Presently, there are 21 students enrolled in the YES 2008/2009 Program.

Evaluation: Data collection instruments originally supplied by the National Science Foundation are used throughout the program to assess short- and long-term goals. Self-evaluation and personal interviews with the students are emphasized. At the end of the workshop, a written survey is taken of students and instruc-

tors to evaluate the workshop's effectiveness. During the year, each student's progress is monitored and evaluated. At year's end, program management, teachers, and mentors review the past year and recommend changes for the next. In recognition of its excellence, YES received an Outstanding Campus Partner-of-the-Year Award (2005) and the Celebrate Success Award (1996) from Northside Independent School District (San Antonio, Texas).

Key Contributing Factors: The success of the YES mentorship program is due in large part to:

- Effective working relationship with Northside Independent School District (NISD) coordination with their academic curriculum (e.g., 1 credit-hour honors ISM course),
- Support from SwRI management and staff, including resources, labor, and funds,
- Involvement of high school teachers to guide specialized student activities, and
- Funds from a variety of agencies: NASA MMS E/PO, NSF, NISD, SwRI, charitable foundations.

Benefits and Lessons Learned: The YES mentorship program has proven to be an effective means of:

- ✓ Providing opportunities for talented students to further their interests in science and engineering and to explore career alternatives,
- ✓ Transferring state-of-the-art technological concepts from the research environment to secondary schools for teacher education,
- ✓ Providing SwRI staff with a source of highly talented and motivated students for possible future employment,
- ✓ Facilitating the SwRI mentor's research interests and desires to participate in community service activities, and
- ✓ Positively affecting our local community.

Summary: Partnerships between research institutes, local high schools, and community foundations, like the Young Engineers and Scientists (YES) Program, can positively affect students' preparation for STEM careers via real-world research experiences with mentorship teams consisting of professional staff and qualified teachers.

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