

2006-1972: ENGINEER STARTERS PROGRAM 2005

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Engineer Starters Program

ABSTRACT

At North Carolina Agricultural and Technical State University, the Engineer Starters Program (ESP) serves as an avenue to target specifically those underrepresented in the Science, Mathematics, Engineering and Technology fields and provide them with tools necessary for success in today's highly technical world. Designed for rising seventh through rising twelfth graders, it is a two-week program, meeting Monday through Friday. (ESP Jr. is an abbreviated version for rising fifth and sixth graders.) The program is a commuter program therefore the students are chosen from schools within a 50 mile radius. Applications are given to the area school counselors and the interested students complete and return an application, hand written essay along with an official transcript (or original grade report) and two letters of recommendation from a teacher and/or school counselor.

The program consists of morning sessions which expand their math and science skills in addition to career exploration. The afternoons expose the students to University research in a manner they can understand. Participants may encounter Computer Applications; Computer Drafting; Electrical Circuits; Nanotechnology and in each area they are coached in Project Presentations. Each area is presented in the form of modules which attempt to relate back to learning outcomes in their public schools. Rounding out the program, other subjects covered include Human Factors/Ergonomics Engineering, Lower Level Supply Chain Management and Web Page Design along with Energy Awareness and Alternatives; Hydrogen Fuel Cells and Photovoltaics. The incorporation of such a variety of subjects stimulates the youths' interests in engineering, in general, and Industrial, Architectural and Mechanical Engineering, in particular. Funding for this program is varied according to the research center involved and comes from varied sources.

STATEMENT OF PURPOSE AND PLAN

This nation has long recognized the absence of diversity within science and math based professions. North Carolina A & T State University (NCAT) has pioneered the effort to encourage women and minorities to consider careers in the varied fields of engineering. NCAT is one of the very few Historically Black Colleges or Universities (HBCUs) that maintains a College of Engineering. Thus NCAT has consistently been near the top, if not at the top, of the annual lists of universities producing engineering graduates. The college offers majors in nine

disciplines: Architectural, Civil, Computer Industrial, Mechanical, Electrical, Chemical, Bio-environmental Engineering in addition to Computer Science. Approximately 40% of the college's students are women. The Engineer Starter Programs primarily target the female and the African American populations but encourage applicants of other ethnicities.

PRE-PROGRAM ACTIVITIES

The Engineer Starter Programs (ESP) positively and effectively reinforces math and science principles to the participants; they also introduce students to applications in engineering. The programs are well known and respected by the residents of Guilford County and the surrounding areas. Formal summer programs within the College of Engineering began in the late 1980's as an outgrowth of the efforts of Professor Reginald C. Whitsett (retired) of the Architectural Engineering Department. When programs are resident, request for applications increase and popularity has spread to the eastern seaboard of the United States, as well as Michigan and New Mexico. Brochures, invitation letters and applications are sent to potential applicants through US Postal Mail as well as via Internet. Application packages are also sent to participants from previous years.

Preliminary planning starts in the fall. Teachers and counselors are contacted to see if they would be interested in helping to facilitate in the program. North Carolina A&T State University Students, both on the undergraduate and graduate level, are also asked if they would be interested in participating. The Engineer Starters Program is the umbrella program for the Para-Researcher Program, Energy Engineer Starters Program, and Engineering Starters Program Jr.

Throughout the spring semester, meetings are convened with the program directors and coordinators, teachers and mentors, to ensure a successful program. At these meetings, dates, budget, curriculum, supplies, room reservations, meals, and other items of concern are discussed.

The registration deadline is normally set for the second week in May. This allows time for preparation of class curriculum and student materials. Because the program is in such high demand there is a late registration period. Recently there have been many requests to the college to develop a program for the younger grade levels. Thus the Engineer Starters Program Jr. (ESP Jr.) was created to accommodate elementary level students in the 5th and 6th grades. These participants are motivated and interested in the world of engineering, math, and science.

A complete application package consists of a completed application form, recent picture of the applicant, latest grade report or transcript with attendance records attached, two letters of recommendations from teachers or counselors, payment, and a one page handwritten paper explaining why the applicant seeks to participate in the program. Any application package that is submitted incomplete is earmarked. The applicant is notified of any information that is missing, and is encouraged to resubmit if any vacancies remain.

APPLICANT EVALUATION

The application process has become competitive. When the applications are received, they are placed in alphabetical order by grade level. An Excel spreadsheet is created to evaluate each applicant in a clear and organized manor. Each student is graded on their Math and Science grades (30 points), English grades (15 points) and writing cultural activities (5 points), attendance (15 points), accountability and values (15 points), interest (10 points), motivation (5 points), and focus and goals (5 points). The maximum score an applicant may receive is 100 points.

Accepted applicants have to complete a series of contracts before participating in the program. Each contract should be signed and dated by both the parent/guardian and the student. By doing this, every participant and his or her parents/guardians are fully aware of what is expected of them, and the consequences that follow, if any of these contracts are breached. Also, the program staff can better cater to every student's individual needs, to help ensure their safety and well being. These contracts include: Participation Contract, Wavier, Parental Medical Consent Form, Informed Consent Form and Field Trip Contracts.

PROGRAM STAFF and FUNDING

The program staff may vary but generally consists of: engineering professors who serve as directors that oversee the programs agenda; other engineering faculty who teach some engineering courses; Guilford County teachers, who served as instructors for the mathematics and science; one (1) high school counselor who facilitates the career explorations and invites other professionals as guest speakers; technicians who conduct the laboratory sessions; six (6) engineering undergraduate students who served as student teachers and mentors; and one (1) engineering undergraduate who serves as the photographer and mentor. The funds for the director come from the College of Engineering outreach and specific sessions such as the CAMSS nanotechnology program is funded by the specific research center.

Once the Guilford County teachers join the program staff, the College of Engineering will provide access to all faculty, laboratories, and materials. All student teachers and mentors undergo a training process to help prepare them for the duration of the program. The entire program staff is well prepared and motivated to work with the students. All the teachers were interesting, yet professional in their approach with each subject. They report directly to the appropriate directors and keeping a positive attitude while at work. The student-teacher relationship grows stronger as the program progresses.

PROGRAM ACTIVITIES

The Engineer Starter Programs are designed to provide education, career awareness, and stimulating activities for elementary, middle, and high school students, i.e. rising 5th through 12th graders. The programs usually operate in two week sessions each year, in the months of June and July. Students are divided into appropriate grade level appropriate groups (i.e. 5th and 6th graders, 7th and 8th graders, 9th and 10th graders, and 11th and 12th graders). Occasionally, an advanced student may be placed in a higher level group based on academic performance.

The Engineer Starters Programs operate from 8:00am to 5:00pm. In the mornings, the students are routinely involved in grade level appropriate Math, Science, Career Awareness, AutoCAD (Computer Aided Design), and Fundamental Engineering Topics. The class periods typically are 45 to 50 minutes in duration. Two breaks are allotted during the morning, one with small snack. At this time participants are allowed to socialize with staff and each other. Periodically each group will visit different laboratories within the College of Engineering. Activities during these periods introduce them to the different disciplines in engineering (e.g. Electrical Engineering, Chemical Engineering, Mechanical Engineering, HVAC, etc) and Waste Management.

Lunch is then provided at the University's main dining hall from 12:00 noon to 1:00 pm. While at lunch the students are allowed to interact with students from other outreach programs on campus. After returning from lunch the students either attend EESP or PRP.

Those that attend EESP participate in a series of lectures, laboratory works, and experiments that introduce them to the world of energy engineering. There the students learn about energy awareness, solar energy, electrolysis, fuel cells and Photovoltaic's.

Those that opt for the PRP will discover the world of Human Factors and Ergonomics, Supply Chain Management and Web Design. Typically a group design project is outlined and assigned to these participants. A popular project is the design of the dashboard of an automobile, although others have been assigned. The project becomes a design competition with monetary awards given to each member of the two or three best submittals.

The Center for Advanced Materials and Smart Structures (CAMSS) in the College of Engineering at North Carolina A & T State University has been involved in joint research with the Center for Nanoscale Chemical-Electrical-Mechanical Manufacturing Systems (Nano-CEMSS) at the University of Illinois Urbana-Champaign in the area of nanotechnology. Representatives from Illinois journeyed to NCAT during the summer of 2004 to facilitate what would become a pilot module for the Engineer Starters Programs. The partners from Illinois, the staff and the participants of ESP enjoyed this module so much that it was enhanced and incorporated into the summer 2005 program by NCA&T faculty. Three area public school teachers were chosen to work on the grant and were

trained to deliver the modules. The teachers worked with CAMSSs faculty to deliver a “Nanotechnology” workshop as a part of The College of Engineering’s, Engineer Starters Programs (ESP). The term, “Nano-” itself means a billionth of a meter. This is 100,000 times smaller than a human hair.

The session activities ranged from discovering the scale of a nanometer, to exploring the nanotechnology revolution. Nanotechnology was likened to the development of the automobile, the assembly line, and mechanical robots. Students discovered how difficult it must be to use current tools and processes for nanotechnology via a modified Lego activity. Nanotechnology will remain a part of the curriculum for the foreseeable future.

Participants also travel on field trips to engineering related sites. Students have visited Catawba College Center for the Environment, Duke Energy Explorium, the Planning Department of the City of Greensboro and the North Carolina A & T State University Farm. In addition there have been trips to Discovery Place Science Museum, Charlotte NC, Procter and Gamble (two plants) in Greensboro NC, Caterpillar in Clayton NC and the North Carolina State University Solar House.

At the end of the combined program, the participants are divided into groups of three or four. The students are then asked to write a paper explaining everything they learned throughout the program and create a display board. Each group will then make a final presentation that is taped and displayed at the closing ceremony. In addition, during the closing ceremony, each student is rewarded with a Certificate of Completion and a Waste Management Certificate. Students that had exceptional performance are recognized with Certificates of Excellence for the hard work and dedication throughout the entire program. Faculty and Staff are also recognized for their contributions to the program with Certificates of Appreciation.

Engineering Starter Program Jr. was newly introduced last summer to the series of Engineering Summer Outreach Programs. It is the first engineering program at North Carolina A & T State University that caters to the elementary level students. The program was created to help instill productive work habits and cultivate strong math and science skills in rising 5th and 6th graders. ESP Jr. operates for one week from 1:00pm to 5:00pm. Each afternoon is split into three categories, math, science and engineering laboratories. In math they revisited the fundamentals of mathematical operations, fractions, decimals, percentage, etc. An Industrial Engineering professor introduced them to Human Factors. The students went to the Electronics Laboratory where they performed hands-on experiments with decorative electrical circuit boards. The Electrical Engineering Laboratory Manager facilitated this activity. Students worked with LEGOs during another module of the ESP Jr. Participants in this program, like their older counterparts, are responsible for group presentation boards which are on display during the closing ceremony. This closing program tends to be more informal.

During the closing ceremony, each student is rewarded with a Certificate of Completion. Students that had exceptional performance are recognized with Certificates of Excellence for their hard work and dedication throughout the entire program. At the end of each closing ceremony, the parents/guardians are provided with a folder of the work completed by their child/children throughout the session, along with a written evaluation and encouraging words for the upcoming school year from their instructors.

RESIDENT PARTICIPANTS

Every year there is, invariably, a large number of requests for a residential component of the program. Residency has been absent from ESP since 1994 because of the increased cost and coordination. The directors have agreed to allow the 11th and 12th graders to reside in on-campus housing while attending the program. This element of the program was primarily created to accommodate students that live outside the local area, who are interested in attending the programs.

TRACKING PROGRAM'S EFFECTIVENESS

The program is beginning a focus in 2006 to discover where and in what the alumni of the program are involved. Numbers and statistics are not available at this time but will be in the future.