A. INTRODUCTION

The Connecticut Pre-Engineering Program, Inc. (CPEP), is a collaboration of school districts, businesses, colleges, universities, government and community organizations whose mission and program efforts are aimed at increasing the pool of African-American, Hispanic, Native-American Indian, Asian American, Women and other under-represented minority students who pursue mathematics, science, engineering and other technological based college study and careers. CPEP provides enrichment programs and activities throughout the year in New Haven.

Since 1987, CPEP has sponsored summer enrichment programs designed to motivate and stimulate middle school and high school students to pursue careers in mathematics, science, engineering and other technology related fields. Through the Summer Enrichment Program, CPEP has been able to better prepare under-represented and urban students with skills that will facilitate their accessing colleges and professional careers.

The essential premise of the program design and academic content is that targeted students must be taught and nurtured as to develop their self-confidence and personal ambitions so that they can seriously plan for and commit to college-level studies.

The program stresses multi-disciplinary "hands-on" science and mathematics experience, group learning and research, and career exploration and academic guidance. Students study under the direction of school teachers and role model undergraduate students. Weekly field trips to industrial sites, science centers and the shoreline are included in this program. Daily lunches and transportation are provided.

New Haven CPEP Summer Program at the University of New Haven operated for five weeks, on Monday through Friday each week, from late June to the end of July. Participants, students just completing the 7th, 8th, and 9th grades, were divided into grade-level groups. On Monday through Thursday, classes were held from 8:00 a.m. until 2:00 p.m., during which students studied chemistry, physics, mathematics, computer studies, language arts/career guidance and one additional class in one of the following areas: foreign language, mathematics or biology. Each subject or study area was offered for 50 minutes daily with 30 minutes provided for lunch. Every Thursday, each class was shortened by 10 minutes to provide time for a speaker/role model to address the group. Fridays were reserved for field trips specially selected by program faculty to provide ongoing experiences in curriculum topics.

At least three follow-up activities were provided to keep this spirit alive.

DISCLAIMER

B. THE EVALUATION METHODOLOGY

The evaluation of The University of New Havens' Summer Program employed a Case Study design using several triangulated research components:

- **A Student Pre-Program Survey** was administered during the first week of the program (See Appendix B - Student Survey Administered at the Start of the 1993 CPEP Summer Program). This survey included questions on general information, educational and career plans, and personal information (demographic information). Additional questions covered topics such as family members working in the sciences, student perceptions on their own scientific career, college major choices, studying habits, and why the student enrolled in this program.

- **A Student Career Interests Survey**, the Harrington-O'Shea Career Decision-Making assessment system, was administered in conjunction with the Student Pre-program Survey (See Appendix C - "Interests" Survey). The Harrington-O'Shea was designed to be an interest inventory with a sound theoretical basis that would do more than provide valid and reliable assessment of career interests. According to the National Institute of Education's Career Awareness Division, effective career decision-making requires a multidimensional approach involving four aspects:

  - Knowledge defined as factual information about work and self;

  - Values as commitment to an object because it is good or right;

  - Preferences, as interest, likings and aspirations; and,

  - Self-Concepts, as beliefs held about abilities one has and how successful one would be at an activity involving the abilities.

  The Harrington-O'Shea Career Decision-Making assessment system was standardized in September when it was administered in 32 school districts to 9,650 students in grades 7 through 12.

- **A Student Post-Program Survey** was administered during the final week of the program (See Appendix D - Student Survey Administered during the Final Week of the 1993 Summer Program). The survey included sections on general information, educational and career plans, student evaluation of the summer program, and student recommendations on improving the program.

- **A Post-Program Parent Questionnaire** was provided to parents at the closing session during the last day of the program (See Appendix F - Post-Program Parent Questionnaire). A letter of explanation and a self-addressed return envelop with the evaluators address accompanied the questionnaire (See Appendix E - Parent Letter). The questionnaire sought to obtain information from parents concerning:

  - their child's interest in math and science;
  - their perceptions of the program;
  - their child's college interest;
  - their career aspirations for their child;
  - their participation in the summer program;
  - their child's involvement and interest in the summer program;
  - their child's attitude about the environment; and,
  - their child's study habits and self-esteem.

- **Staff, Teacher, and Guidance Counselor/Tutor Interviews** were conducted during the program. To illicit a wide range of responses, an open-ended survey schedule was used. The guidance counselors/tutors were interviewed in a group setting. Teachers and staff were interviewed individually.

- **Student Interviews** were conducted during the last week of the program in a small group setting.

- **On-site Observations of Program Activities** were conducted during the second week of the program and the last two weeks of the program. Classroom and guest lecture presentations were observed.

C. PROGRAM RESULTS

The Summer Program's success in meeting its goals and objectives is the primary mechanism in determining program results. The obtaining of goals and objectives was determined through the use of the following research methodologies:

- o A Student Pre-Program Survey;
- o A Student Interests Survey;
- o A Student Post-Program Survey;
- o A Post-Program Parent Survey;
- o Staff, Teacher, counselor/tutor Interviews;
- o Student Interviews; and,
- o On-site Program Observations.

For this Final Evaluation Report, information was obtained from all of the research methodologies except the Post-Program Parent Questionnaire. Unfortunately, only seven of the parent questionnaires were returned, representing less than a 17 percent return rate. Because of the minimal representativeness of the returned parent questionnaires, the Final Evaluation Report does not include information from the parent questionnaires.

Goal 1. To offer target secondary students from urban districts enrichment and in-depth learning experiences.

Objective 1.0

To identify, recruit and enroll 40 New Haven middle school and high school minority students with an interest and aptitude in science and mathematics through the help of their parents, guardians, school guidance staff, teachers, and CPEP advisors into the CPEP Summer Program.

SURVEY FINDINGS

Student Selection

Seventh, eighth and ninth grade students from thirteen New Haven public schools were selected to participate in the Summer Program. Each student had to complete an application and submit it to the CPEP Office by March 19, 1993. The application was accompanied by two teacher recommendations, a student essay, the student's grades, and the student's involvement in other activities.

A screening committee consisting of Betsy Hogan from the University of New Haven and Jimmy-Lee Moore and Mrs. Linda-Lee Andrews (CPEP teachers) screen students prior to interviews. The criteria and scoring for evaluating potential program candidates is based on a five point scale over four categories:

(1) Teacher recommendation;

(2) Essay (scored based on neatness, organization of thoughts/clarity, spelling/correct word usage, etc);

(3) Grades (primarily in English, Science, and Math); and,

(4) Overall application.

The overall scores are added and those students with the highest scores are admitted to the program. A total of 40 students were selected to participate in the UNH Summer Enrichment Program.

This year, several students, who did not meet the typical student profile of incoming CPEP students, were admitted to the program. These students did not do well, so next year the program will be strictly adhering to its admission standards.

Student Recruitment

CPEP teacher Jimmy-Lee Moore attempts to recruit students 12 months a year through word of mouth, PT meetings, interchanges with students, press releases, citizen television ads, articles for several school newsletters, the New Haven Register, and the Inner City Advisor. In addition, a video taped presentation of last year's program was shown at each school to assist with recruitment. On May 15, 1993, the University of New Haven hosted a CPEP Day. Over 300 inner city middle and high school students, teachers, parents and volunteers attended this day of science competitions and awards.

SURVEY FINDINGS

Thirty nine percent of the students were 13 years old (n= 14) and about a quarter were 14 and 15 years old each (n= 17). Approximately two-thirds of the students were males (22 males to 14 females).

Enrolling students clearly represented the target ethnic groups. Two thirds of the students were African-American. Caucasian, not Hispanic and Hispanic students each represented 8 percent of the student population.

Students were almost split evenly across three grades (i.e., seventh through ninth during the previous school year), although the largest number of students (i.e., thirty nine percent) will be entering the eighth grade in the coming school year.

According to the students themselves, the vast majority obtained excellent grades during the preceding school year in math, science, and other subjects. Because school grades were self-reported, the number of A and B grades was probably exaggerated.

The primary means that students become aware of the Summer Program was through teacher announcements (i.e., 51 percent). Almost one third of the students heard about the program through other more informal forms of communication ranging from a teacher or guidance counselor at school recommending it, to a mother and a teacher involved with the CPEP program.

In addition to the 6 students that returned to the UNH CPEP for a second year in the Summer Program, almost one third of all the students had attended a similar, although not as intense, program prior to enrolling in the UNH Summer Program. Ten students had previously attended 6 different programs.

Objective 1.1

> Students will engage in guided measurement and experimentation in the University's engineering and science laboratories.

Objective 1.2

> To offer participants an integrated, "hands-on" and multi-disciplinary learning experiences in mathematics, the sciences, and computer applications during the summer.

FINDINGS

Students were exposed to multi-disciplinary learning experiences in the study of the biosphere (biology), mathematics, chemistry, physical science (physics), and computer application in addition to practicing guided measurement and experimentation. Students take five classes a day. The seventh and ninth grade students take physics, and the eighth grade students take biology.

A brief description of the design and objectives of these courses follows:

- **The Study of the Biosphere**

Students studied different parts of the ecosystem and became adept at identifying the biotic and abiotic subsystems, and thus understanding the intricacies of different ecosystems.

- **Mathematics**

The Math course was designed to integrate the student's mathematical skills with science practices. The objective of the course was to increase the student's interest and ability in mathematics, by developing a more positive attitude towards the subject by direct and relevant applications. The course placed emphasis on graphing, metric measurement, solving equations with the use of properties and problem solving.

- **Chemistry**

The Chemistry course was designed to introduce students to the exciting world of Chemistry. Students developed skills and techniques necessary to carry out scientific investigations. Students participated in a four week experiment which required daily work. Students also explored the world of acids and bases chemistry, chemical nomenclature, and environmental (personal habitat) chemistry.

- **Physical Science**

The objective of the Physical Science course was to provide students with the knowledge to extrapolate the ideas of force and motion. Students participated in several different experiments including:

(1) Speed and Velocity;

(2) Acceleration;

(3) Mass and Force;

(4) Newton's Laws,

- inertia,
- acceleration,
- momentum, and
- action - reaction; and,

(5) Work and Machines.

o **Computer Applications**

The computer course was designed to broaden the student's computer experience. The course offered students the opportunity to utilize computer programs for mathematical and scientific research. Students became submersed in developing and using:

- graphs;
- creating databases; and
- organizing spreadsheets.

Students also sampled the "real" world of engineering through bridge building programs.

Goal 2. To expose participants to the world of higher education study, research and inquiry during the summer and following year.

Objective 2.0

Participants will learn to design science projects and conduct scientific research.

FINDINGS

Students designed a wide variety of science projects and conducted scientific research in the chemistry, physical science and computer application classes.

Objective 2.1

Students will stay involved with CPEP during the school year as a result of the Summer Program.

FINDINGS

The 1993-1994 Follow-up Schedule for Parents and Students

October 19	Financial Aid for College
October 23	General Session and Speaker
November 9	Admission to College
November 13	Lunch on Campus, followed by a College Football Game

December 11	Speaker
January 22	Ski Trip
February 26	Speaker and handing out of summer material
March 19	Students and Parents in the Chemistry and Physic Labs

Goal 3. To acquaint industrious urban minority youth with the prerequisites for secondary and postsecondary study in mathematics and science.

Objective 3.0

Design and implement a multi-disciplinary "hands-on" science and mathematics experience through group learning and research.

FINDINGS

Goal 3 and Objective 3.0 are similar to Goal 1 and Objectives 1.1 and 1.2, therefore the same "findings" from Goal 1 apply here. In addition, survey findings provide additional information on student attitudes on taking more mathematics and science course in school.

SURVEY FINDINGS

The Pre-Program Survey attempted to determine future student interest in science course in school. Exhibit - Student Interest in Taking More Science & Mathematics Courses at School, documents that more than three-quarters of the students were either "very interested" or "extremely interested" in taking more of these course at school. The Post-Program Survey response to the same question reveals that 40 percent of the students are now "extremely interested" taking more science and math courses compared to only 23 percent at the Pre-Program Survey.

The Student Pre-Program Survey elicited responses on the selection of college majors by first, second, and third choices. The top first choice was "Other" with 30 percent of the students selecting this category, followed by "Engineering" at 16 percent and both "Computer and Information Sciences" and "Business and Commerce" at 8 percent each. Students were "very certain" of three-quarters of all first choices and "fairly certain" in one-quarter of all first choices. Although students entered the program with a 97 percent likely certainty of their first choice of college major, several students changed their choices after experiencing the UNH Summer Enrichment Program.

However, the only significant increase occurred in Engineering which was selected as the first choice by 20 percent of all Post-Program Survey respondents compared to 14 percent of all Pre-Program respondents.

Goal 4. To provide academic planning and guidance for participants and their parents to help ensure students' postsecondary access to mathematics and science disciplines.

Objective 4.0

Participants will design an academic course schedule to help them meet requirements for admission to a college-level engineering program.

FINDINGS

The complete design of the academic course schedule will be completed early in the coming school year. However, the Guidance curriculum objectives that were accomplished included:

(1) Students were provided information about middle and high school programs offered in the New Haven Public Schools;

(2) Students began to understand the importance of maintaining good grades;

(3) Students began to realize that they affect their own future;

(4) Students began to understand the concept of "critical thinking";

(5) Students became sensitized to issues of race and gender;

(6) Students were introduced to various employment opportunities in the fields of science and engineering; and,

(7) Students were taught how to interview successfully.

Objective 4.1

Students will participate in a college admissions workshop to learn the application process and how to participate successfully in admission interviews.

FINDINGS

An "Admissions to College" session is scheduled for parents and students on November 9, 1993.

Objective 4.2

Admissions and Financial Aid workshops will be held in the fall for both students and parents.

FINDINGS

A "Financial Aid for College" session is scheduled for parents and students on October 19, 1993.

Goal 5. To bring participants into contact with role models in mathematics, science, engineering and technology careers.

Objective 5.0

Students will gain an improved understanding of careers in science, mathematics and engineering by being exposed to positive role models in engineering, education, and business.

INTERVIEW FINDINGS

Role models including engineering and scientific experts and University faculty joined in the guidance/career awareness segment of the curriculum.

The program is staffed with 5 teachers and 4 tutor-teacher aids. The racial and gender make-up of the teachers and tutor/teacher aids is as follows:

TEACHERS

(2) = African-American male;

(2) = Caucasian female; and,

(1) = Caucasian male;

TUTOR-TEACHER AIDS

(1) = African-American female;

(1) = Asian-American male;

(1) = Caucasian male; and,

(1) = Caucasian female.

A brief summary of the staff's experiences is provided below.

TEACHERS

Mrs. Linda-Lea Andrews joins returned for a third year to teach Chemistry for CPEP. Mrs. Andrews currently teaches Chemistry, Chem Study (Honors), and has taught A.P. Chem at Valley Regional High School in Deep River, Connecticut.

Andre' C. Dupree returned for a fourth year as the CPEP mathematics teacher. He is currently a guidance counselor at Hillhouse High School in New Haven. Mr. Dupree has taught math at the middle school level for several years and has a perpetual love and interest for the subject.

Mr. Steve Kass returned for a fifth year to teach computers in CPEP. He is also the CPEP Curriculum Coordinator for the summer program. He is currently a teachers at the Cooperative High School in New Haven; teaching math, science, and computers. Mr. Kass has been teaching for nineteen years at two alternative high schools (High School in the Community and the Cooperative High School).

Jimmy-Lee Moore returned for a fifth year as Head Teacher and teaches English/Guidance. Throughout this academic year, and the last academic year, he has been one of two Guidance/Parent Coordinators for CPEP.

Mr. Moore has been a teacher in the New Haven Public School System for seventeen years, teaching grades two through eight. During the last seven years he has been a teacher in the Talented and Gifted Program.

Mrs. Jennifer Stassen is in her first year at the CPEP Summer Enrichment Program and teaches Physics.

TUTOR-TEACHER AIDS

The use of teaching counselors provided the CPEP students with daily mentors that they could look-up to and aspire to emulate. These mentors have all had recent success, and were positive role models. Their backgrounds are as follows:

Christine Karbwnyk is a UNH student, graduating in January 1994 with a double major in Forensic Science and Chemistry. She has been a Laboratory Assistant at UNH for three years and a Chemistry Assistant.

Chen "Data" Zhou was a third year Teaching Assistant in Computers and Math. In the 1993 State Science Fair he placed first in Computer Science, second in Physical Science, and third in math.

Masequa Pina is a graduate of the High School in the Community in New Haven. She will be entering the University of New Haven in September 1993 majoring in Electrical Engineering. She was a first year Teaching Assistant in Physics, Math, and Biology.

Marcia Johnson was a fourth year returning Teaching Assistant in English/Guidance. She is a senior at Southern Connecticut State University majoring in Epidemiology. She is employed at Yale New-Haven Hospital.

UNIVERSITY OF NEW HAVEN STAFF

Dr. Carl Barratt served as Faculty Program Director and had participated in the program in past years.

Dr. Ira Kleinfeld, the Assistant Provost and Dr. Donald Fridshal, Chairman of the Mathematics and Physics Departments acted as Program Consultants.

Betsy Hogan served as CPEP Site Coordinator and Director of the Summer Program.

SURVEY FINDINGS

The Student Pre-Program Survey produced unexpected responses from students who have not been extensively exposed to an intensive science program. One half of the students estimated that the likelihood of their becoming a scientist, engineer, or mathematician in the future was better than 50 percent. At the conclusion of the summer program, more students now believed that they had a better than 50 percent chance.

Students also overwhelmingly selected "engineering" (29 percent) and "medical and biological sciences" (23 percent) as their likely career choice.

The Harrington-O'Shea Occupational Interest Survey provided a more reliable and valid assessment of student career interests. The Interest Survey provides information on each student's "highest interest area" and "second highest interest area" in addition to the students grade level. More than half (18 out of 34) of the students selected a scientific career as their "highest interest" area.

The Harrington O'Shea Occupational Interest Inventory encouraged students to become aware of their occupational interests; helped students identify potential careers; and helped students make the connection between activities which they find interesting and corresponding careers.

Goal 6. To strongly emphasize career exploration through various industrial and research center visitations and field trips.

Objective 6.0

Students will witness engineering in action at industrial and business locations during weekly field trips.

FINDINGS

To provide a successful opportunity for UNH Summer Program students, the program scheduled both field trips and special guest speakers.

Four field trips provided each student with the opportunity to expand their knowledge of scientific professional opportunities. The field trips were to the:

(1) Great Hollow Wilderness School for team building skill development and motivation (June 29 & July 9);

(2) Schooner Argia/Sonalyst for the study of Marine Biology and the Environment (July 16);

(3) Regional Water Authority East Shore Waste Treatment Plan for learning about water treatment and sewage treatment (July 21); and,

(4) Green Pastures Solar Museum for learning about solar energy (July 23).

Five guest speakers provided students with information ranging from the environment to personal motivation. The speakers and their topics, which were patterned on this summer's basic theme of "problem solving," were:

(1) Joel Meisel, Ph.D. and Southern Connecticut State University Faculty, on "Rainforests" (June 30);

(2) Don Richardson, Southern New England Telephone, on "Telecommunication" (July 1);

(3) David Beckerman, Starter Sportswear, on "Business/Motivation" (July 8);

(4) Will South, Echlin Company, on "Computer Technology" (July 15); and,

(5) Ms. Somers, U.S. Air Force, on "Careers and Motivation" (July 22).

Goal 7. To strengthen the oral and written communication skills of participants.

FINDINGS

All students were enrolled in an English/Guidance class taught by Jimmy-Lee Moore. This class offered students the opportunity to become more proficient writers, orators, debaters and critical thinkers. Student oral and written communication skills were embellished through practical applications. In addition, students learned about the middle and high school programs offered in the New Haven Public School system, as well as the best ways to set and attain their future goals.

The English/Guidance course accomplished a range of objectives. The English objectives that were accomplished included:

(1) Students acquired the elements necessary for research writing;

(2) Students learned to share ideas and data with one another;

(3) Students became more aware of the importance of detail and supportive data in research writing;

(4) Students learned to write more efficient lab reports;

(5) Students became more aware of the importance of self discipline in research writing;

(6) Students learned that proof reading and multiple draft writing are a necessary component of effective communication;

(7) Students acquired skills in presenting information orally;

(8) Students increased their vocabulary usage; and,

(9) Students learned to utilize the dictionary as a life tool.

Objective 7.0

Students will be able to incorporate personal computers as a major learning tool.

FINDINGS

The computer applications course provided students with knowledge and skill development in personal computers. Some of the basic curriculum that was offered include coordinate math, the graphing primer, graphing, the lunar greenhouse, and data analysis.

Goal 8. To help build self esteem and confidence of participants.

SURVEY FINDINGS

The Student Pre-Program Survey provided a variety of information on student motivation levels, student educational aspirations, and family demographics such as parent educational levels and family members working in the sciences.

The amount of time that students think they study provides some information on their motivational level. Forty percent of the students reported that during the school year they studied, on average, for more than 2 hours every day after school. Twenty two percent reported that they studied 5 days or more a week during the school year. Thirty three percent studied three days a week. However, 41 percent studied two days or less a week.

At the completion of the program, students were asked how much they plan to study during the coming school year. Post-Program Survey responses show that students now plan to study much more. Sixty percent stated that they planned to study for more than 2 hours a night. Furthermore, 8 students stated that they studied only one day a week or less on the Pre-Program Survey and only 2 students now reported that they planned to study this low amount. Also, 10 students reported in the Post-Program Survey that they planned to study for 4 or 5 days a week versus 3 students that claimed that they studied this amount on the Pre-Program Survey.

About half of the students reported that they had family members working in a science related job, and more than half reported that they had more than 2 family members working in a science related job. Even more surprising, more than a quarter had three of more family members working in a science related job. Unfortunately, "science" and "type of job" are not defined, so working in a science related field could mean any job in the health industry or similar field and any type of job.

Student educational aspirations, and especially interest in science and math are important factors in determining if the right population has been selected for intensive summer programs. In the Student Pre-Program Survey, students were first asked the question: How far in school "would you like" to go? Over one-third planned to graduate from college, but an two-thirds planned to attend a higher level of school after graduating from college, implying that at least 100 percent planned to graduate from college.

At the conclusion of the summer program, students were asked the same question. Although the Pre-Program/Post-Program Exhibit titled "How far Students would like to go in school" shows that fewer students in the Post-program Survey selected to graduate from college and go to graduate school, an actual decline did not occur because fewer students completed the Post-Program Survey.

Earlier in the Student Pre-Program Survey, students were asked: How far in school "do you think you will go?" This question was designed to compare "aspirations" with the "perceived reality." Responses are almost identical to the previous question on how far in school students would like to go. The Post-Program Survey responses to this same question are again, not noticeably different.

Goal 9. To produce an evaluation of the Summer Program.

Objective 9.0

To provide National Science Foundation officials with follow-up data regarding Summer Program participants and to continue to conduct in-depth program evaluations and other longitudinal studies assessing Summer Program participants' progress and overall Summer Program functioning.

Dr. Todd Rofuth, Director of The Center for Urban Studies at Southern Connecticut State University, produced this Final Evaluation Report. In addition to previously documented information, several additional observations provided important information concerning the operation of The University of New Haven's summer program.

SURVEY FINDINGS

Students had an opportunity to evaluate the program at the Post-Program Student Survey. The students overwhelming supported the program.

D. PROGRAM CONCLUSIONS AND RECOMMENDATIONS

- Many of the girls are showing signs of low self-esteem, some of the boys also, what can we do about it?
  - Schedule a time for a group meeting, to reinforce the females.
- Recommend a self-esteem pre-test and post-test next year.

- o The final night program closing session went real well. Parents participated in the math competition with their children. Some parents refused to participate with their children in the physics/biology sessions.

  - Schedule more time for the lab experiences next year.

- o Future admissions procedures should be modified:

  - For next year several more several more applicants should be accepted and then within the first couple of days, the students who do not belong in the program should be released.

  - Every ninth grader was accepted into the program. A more selective application process should be created for this group.

- o It takes about one and a half week to get the students acclimated to the program.

- o The idea of a special certificate for superior performance should be considered.

- o Action should be taken to help students obtain an elective credit from their school for participating in this program?

- o A pre-entry package should be designed and provided to the students to return on the first day so that additional information can be collected on student ability. This package should be part of the post application acceptance process, otherwise, parents or peers might answer questions for them.

- o A different application process should be developed for returning students.

- o Parents appear to be writing some of the application essays. If this is suspected, the rest of the student's application package should be closely scrutinized.

- o Field trips are an inherent component of the curriculum and should not be optional?

- o More class room experiments should be scheduled when possible.

- o Although individual homework was not required, group challenge reports were produced on water pollution, acid rain, etc. These type of group experiences should be expanded.

- o Teacher/counselors should be recruited who can work closely with students and are closer in age to the students.