

FINAL REPORT (YEARS 1998-1999-2000)

**NATIONAL HISPANIC BILINGUAL ENGINEERING PROGRAM
(NHBEP)**

DOE Patent Clearance Granted
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I. EXECUTIVE SUMMARY

The National Hispanic Bilingual Engineering Program (NHBEP) is a cross cultural project geared toward recruiting and retaining a cadre of bilingual engineers. A Consortium consisting of five stateside institutions (Richard J. Daley Community College, Chicago, Illinois; Hostos and LaGuardia Community Colleges, New York City; Luna Vocational Technical Institute, Las Vegas, New Mexico; San Antonio College, Texas; two Engineering Schools in Puerto Rico: Turabo University and Polytechnic University) and Equity Research Corporation, a non for profit organization chartered under section 501(c)(3) of the Internal Revenue Code and located in Washington, DC, represent an innovative approach to facilitate access to the field of engineering to a historically under-represented group within the context of this profession; namely Hispanic students. Another goal of NHBEP was the development of a national model which could be replicated for other target careers and populations particularly minority recruitment and retention in professional school education.

This report describes program goals, activities, processes, benefits for the profession of engineering and for the project participants, coordination, and impact of NHBEP throughout the three years of implementation.

In summarizing project outcomes for NHBEP during its three years of funding (1997-2000) is valid to report that the data analyzed, including review of

documentation, surveys, interviews, focus groups, and observations revealed a pattern of effective implementation of NHBEP's project objectives. In particular, NHBEP was highly successful in its objectives related to planning/coordination, networking, orientation for potential and enrolled students, staff development activities, curriculum revision/development in the areas of bilingual language skills and engineering content and a description of the process and products for the development of a replication model.

II. INTRODUCTION

The following report represents a comprehensive and detailed overview of the National Hispanic Bilingual Engineering Program (NHBEP), a United States Department of Energy Grant awarded to Equity Research Corporation on behalf of the project consortium consisting of five stateside institutions (**Richard J. Daley Community College**, Chicago, Illinois; **Hostos** and **LaGuardia Community Colleges**, New York City; **Luna Vocational Technical Institute**, Las Vegas, New Mexico; **San Antonio College**, Texas); and two Engineering Schools in Puerto Rico (**Turabo University** and **Polytechnic University**). The NHBEP is a cross cultural project geared towards recruiting and retaining a cadre of students to become bilingual engineers.

The report will describe program goals, activities, outcomes, processes, benefits for the profession of engineering and for the project participants, coordination and capacity building, effectiveness and impact of the NHBEP throughout the three years of implementation.

THE NATIONAL HISPANIC BILINGUAL ENGINEERING PROGRAM

The NHBEP proposal was developed to address one of the goals of the US Department of Energy (DOE) (Hispanic Outreach Initiative), which was to rectify the disparity which exists in terms of access and opportunity for Hispanics in under-represented fields such as mathematics, science, and engineering. The project mainly focuses on students with various levels of English and Spanish proficiency, who have the potential to become bilingual engineers if they study in a cross-cultural context. **This project addressed the current need to increase the number of Hispanic youth entering pre-engineering programs in high schools and in the community colleges. Currently, this population is markedly under-represented.** It was also the purpose of the NHBEP to create an innovative program that uses a consortium of Hispanic serving community colleges to create a pipeline with local educational agencies in their areas to recruit high schools students in pre-engineering and to use the community colleges as feeder institutions to two Schools of Engineering in Puerto Rico. Depending on the project participants' linguistic skills in either or both languages, they are matched to one or other of the engineering schools. One School of Engineering (Turabo) teaches its curriculum in English while the other (Polytechnic) teaches its curriculum in Spanish. In both cases, participants are exposed to a bilingual environment by living in another society with Spanish as the first language.

The demographics are alarming in terms of the preparation of Hispanic engineers in the United States. In 1990, according to a National Science Foundation Report, only 3.2 percent of engineers in the civilian labor force were Hispanic (1996). In 1997, the United States imported the same number of engineers as those graduated from U.S. engineering schools. These figures accentuate the need for a project such as the NHBEP to address present and future needs. In order to increase Hispanic representation and facilitate the process of other groups, the program was described and conceptualized in a way that could lead to a replication model for future projects, populations, and professions.

III. NEED FOR THE NATIONAL HISPANIC BILINGUAL ENGINEERING PROGRAM (NHBEP)

“Cross-Culture Competence is considered by members of both the academic and corporate communities to be the most important new attribute for an individuals effective performance in the global marketplace.”

The American economy is currently a global one. Goods, services, and information flow freely across borders and among trading blocks. Emerging new technologies, including fiber optics, digital communications, and powerful computers, accelerate the speed of these developments, and multiply linkages between and among all regions of the world. Professional and technical skills alone will no longer guarantee success. The increasingly integrated global economy

requires that all professionals understand the people and heritages of other nations and regions, and that they are able to communicate across national, cultural, and socioeconomic boundaries. The National Hispanic Bilingual Engineering Program (NHBEP) presents an innovative approach to develop a cadre of bilingual engineers with the main goal of facilitating access to an historically under-represented group. Another goal of the NHBEP is the documentation of the creation and coordination of a partnership among Hispanic Serving Institutions to develop a capacity-building model for articulation with professional schools of engineering.

A rapidly changing and diverse American society demands that future engineers appreciate and respect the constructive role that diversity has played in the development of the United States, and the crucial role that inter-cultural, cross-cultural diversity, and bilingualism have played and will continue to play in the next century in harnessing our nation's intellectual, social, and technical resources. The National Hispanic Bilingual Engineering Program empowers its participants to employ a developmental learning community perspective which is bilingual, multi-cultural, and technologically up-to-date for the next generation of engineers.

IV. DESCRIPTION OF NHBEP SITES

In its original proposal to the U.S. Department of Energy, the National Hispanic Bilingual Engineering Program included five institutions of higher

education in the United States and one university in Puerto Rico; namely, Turabo. Subsequently, Polytechnic University in Puerto Rico was added to bring the consortium to seven in total. Each of these institutions is a Hispanic Serving Institution. The NHBEP also included a non profit educational consulting firm which served as grantee and coordinating organization for the entire program. A brief description follows:

A. Equity Research Corporation (ERC):

Equity Research Corporation is a non for profit organization chartered under section 501(c)(3) of the Internal Revenue Code and located in Washington, DC It has a track record of extensive involvement in college and university education focusing on providing educational opportunities for Hispanic students. The president and personnel of ERC have coordinated the development of memoranda of understanding between institutions of higher education within the United States of America, throughout the Caribbean and Latin America and the national science laboratories . It is a bilingual organization with demonstrated dedication to capacity building for Hispanic Serving Institutions.

In this program, ERC in collaboration with member institutions has coordinated the processes for planning and implementation for all program activities, including: (1) securing the participation of seven institutions of higher education; (2) promoting the program's objectives; (3) assisting the colleges and universities in the selection of the NHBEP on -site coordinators; (4) in collaboration with participating institutions, assisting in the development, implementation and the coordination of the program activities, including networking between and among the program participants; (5) serving as point of contact and liaison with the Department of Energy, other

federal agencies, and the various program agents in both the public and private sectors; and (6) serving as monitor of program progress and expenditures.

B. Turabo University (TU):

Turabo University is a private non-profit institution of higher education located in Puerto Rico, 15 miles southeast of San Juan. Established in the academic year 1990-91, the School of Engineering offers baccalaureate programs in Manufacturing Engineering and Mechanical Engineering with an option in Manufacturing. It also offers a baccalaureate program in Electric Engineering with options in Telecommunications, Electronics, Electric Power, and Computers.

Turabo University's School of Engineering is a fully established bilingual institution located in an Hispanic cultural environment where engineering courses are taught in English. Students are also given the opportunity to develop language proficiency and skills in both the English and Spanish languages. Along with scientific and professional training, students receive academic support for the improvement of English language skills. The university is fully accredited by the Middle States Association of Colleges and Universities, and the Engineering School is a candidate for accreditation by the Accreditation Board for Engineering and Technology (ABET).

C. Polytechnic University of Puerto Rico (PUPR):

Polytechnic University of Puerto Rico is a private, not for profit, coeducational nonsectarian institution founded in 1966. Until 1974, it offered specialized courses in Land Surveying and Mapping. In 1974, PUPR became a degree granting institution with a BLS and a Bachelor's Degree in Science in Civil Engineering. These degree programs were followed by Industrial Engineering (1980), Electrical Engineering (1984), Mechanical Engineering (1987), Business Administration with a major in Industrial Management (1990), an Computer Engineering (1991). In 1992, the institution started offering, a Master's Degree in Engineering Management.

In 1995, a Bachelor of Science in Architecture program was initiated. Polytechnic University was re-accredited by the Middle States Association of Colleges and Schools in June 1990. The Accreditation Board for Engineering and Technology (ABET) accredited the four engineering programs in 1996.

D. Richard J. Daley Community College (Daley) of City Colleges of Chicago:

Daley Community College offers 29 academic programs toward the Associated Degree in business telecommunications, the health sciences, teaching technology and the arts. Of its 20,256 total student enrollment, around 51 percent are of Hispanic origin. The college fosters innovative classroom teaching, strong support services for students and professional development opportunities for faculty. Daley Community College is prepared to offer students an associate degree in engineering that will allow them to transfer and obtain a B.S. in Engineering at Turabo School of Engineering.

E. Eugenio María de Hostos Community College (Hostos) of the City University of NY:

Hostos Community College is one of the few fully bilingual community colleges in the nation. Since its foundation in 1969, Hostos has been in the top ten of all community colleges in the number of associate degrees granted to minorities, especially Hispanics and women. Hostos presently serves approximately 5,000 students, of which 80 percent are Hispanics. With a student body that nears 100% passing rates each year on State or National Boards in Radiology Technology,

Nursing, and Dental Hygiene, Hostos is meeting its mission of providing excellent educational opportunities for a traditionally under served population.

F. Fiorello H. LaGuardia Community College (LaGuardia):

LaGuardia Community College, one of the 17 undergraduate colleges of the City University of New York, was founded in 1970. LaGuardia serves the immediate surrounding area of western Queens, as well as the larger New York City metropolitan area. A large number of students are recent immigrants from many countries throughout the world. Out of a total enrollment of 11,080 students, 37 percent are Hispanic. Through its array of 30 academic programs, the college serves matriculated students working toward both associate degrees and certificate programs. The college offers programs leading to three degrees: the Associate in Arts, Applied Sciences, and Science. It also serves a large and diverse population of students in its many non-credit continuing programs and through its Cooperative Education Program.

G. Luna Vocational Technical Institute (LUNA), New Mexico:

Luna Vocational Technical Institute is a comprehensive two-year community college accredited by the North Central Association of Colleges and Schools (NCA). The institution is located in Las Vegas, New Mexico, and serves the populations of six school districts in the northeastern sector of the state. LVTI offers 33 academic programs. It recently launched degree programs in Business

Accounting, Computer Programming, Nursing and Medical Laboratory Technician.

A total of fifteen Associate in Applied Science Degrees are offered. The institute serves approximately 2,459 students, 79% of whom are Hispanic.

H. San Antonio College (SAC), Texas:

San Antonio College is a comprehensive community college serving more than 20,000 students. It is the largest of the four independent community colleges comprising the Alamo Community College District. The college serves the diverse population within the San Antonio metropolitan area by providing high quality programs in the liberal arts and sciences, general education, career education, continuing education, and developmental education. A strong ESL component supports all of SAC's programs. San Antonio College courses fulfill degree requirements for Associate in Arts, Associated in Science, and Associate in Applied Science Degrees as well as for transfer to Baccalaureate programs at senior institutions such the University of Texas and Texas A & M. Approximately half of the student populations of Hispanic origin, and two thirds of all students are enrolled in academic programs.

V. PROJECT OVERVIEW

The mayor goal of the National Hispanic Bilingual Engineers Program is "to **increase the numbers of trained bilingual engineers in the United States**

through a comprehensive and collaborative model partnership program”. This goal is to be accomplished through a three year process of planning, coordination, recruitment, orientation, and placement of high school students in pre-engineering programs and students from the five community colleges in the U.S. into the two Puerto Rican engineering schools of the consortium. The specific objectives of the NHBEP in achieving its overall goal are as follows:

1. To coordinate between high schools and community colleges in the United States and engineering programs in Puerto Rico to recruit, train, place, and retain Hispanic students for the profession of engineering;
2. To hold a series of meetings of members of the consortium for purposes of planning, networking, coordination, and staff development;
3. To have a program coordinator appointed at each of the institutions in the consortium;
4. To create a NHBEP advisory board at each program site;
5. To coordinate fund raising and the procurement of other financial support for students and program faculty and/or coordination of already existent grants that can scaffold NHBEP for providing students financial assistance; curriculum development; and/or faculty training at each of the institutions;
6. To develop and implement procedures for the transfer of credits from the U.S. institutions to the engineering programs in Puerto Rico;
7. To develop and implement orientation and pre-entrance activities for potential candidates for the NHBEP in the U.S. and Puerto Rico;
8. To revise/develop appropriate curriculum at the community colleges to facilitate the preparation and transfer of their students to actual engineering programs in Puerto Rico;
9. To develop opportunities for program participants to develop their bilingual linguistic skills while becoming engineers;
10. To assist program participants (students) in acquiring financial aid packets and summer internships;

11. To provide staff development for site program coordinators and personnel in the areas of, but not limited to, students development, grant writing, curriculum revision, recruitment of students, bilingual/multi cultural education, and professional school education;
12. To describe the NHBEP's planning, implementation, effectiveness and impact as a model which could be replicated for other target careers and populations, particularly minority recruitment and retention in professional school education.

VI. PROJECT EFFECTIVENESS AND ASSESSMENT PROCESSES

The determination of the extent to which the proposed objectives were achieved through program activities and processes included a variety of assessment strategies as well as external evaluations. The first strategy was descriptive in nature and centered on a review of the approved scope of activity and documentation, including, but not limited to the following:

- the proposal for funding;
- correspondence from the national office;
- correspondence from specific sites;
- quarterly reports;
- meeting agendas;
- minutes from meetings;
- materials prepared at individual sites;
- syllabi;
- recruitment brochures; videos;
- workshop/staff development information; and
- curricula.

Other evaluation strategies were related to program implementation and impact and consisted of surveys and focus groups among the project site directors personnel, students, and faculty. The surveys were structured to elicit data regarding specific objectives of the NHBEP for the three years activities. The survey questions canvassed effectiveness in the areas of planning and coordination for the implementation phases of the projects. In addition to the ratings, qualitative questions related to specific strategies which could be applied at individual sites; the

particular strengths of the activities; areas in need of improvement; and general comments/recommendations were also elicited.

Another strategy consisted of different structured interviews. The first was a series of interviews conducted with a sample of the NHBEP site coordinators at four of the seven program sites. The second set of interviews took place with all the NHBEP site coordinators present during the March 1998 meetings in Puerto Rico. Questions for the former focused on: (1) their role within the project and institution; (2) their background and skills useful to the program; (3) their expectations for the NHBEP during the first year and the extent to which their expectations had been met; (4) highlights of the year's activities; (5) obstacles encountered in carrying out the program objectives, and (6) agenda items or recommendations for the second year of funding. For the interviews conducted during the March 1998 meeting in Puerto Rico, the questions were as follows: (1) What are your general impressions about the success of the project in achieving its objectives?; (2) To what extent did the sessions at Polytechnic meet your expectations?; (3) To what extent did the sessions at Turabo meet your expectations?; (4) What were the highlights of the visit in terms of your individual site?; (5) What will be your next steps in the process at your institution?; and (6) What are your needs in order to effectively carry out the NHBEP goals?

Interviews were conducted with students at three sites (Turabo, Polytechnic, and San Antonio College). Also, during the summer program in Puerto Rico, in 1998 and the Summer Bridge program in July 1999, students were interviewed. They were asked: (1) How they became interested in the program; (2) What support services they had received; (3) Their impressions of the NHBEP and its effectiveness; (4) Needs they identified for facilitating their entrance and exit from the program; and (5) Their overall impressions of the program. Finally open-ended interviews were conducted periodically with the national office director and staff, and with

administrators (e.g. president's and vice-presidents at the NHBEP program institutions). These interviews focused on their vision, sense of progress, needs, challenges, and future directions.

Observation data was collected at a series of planning meetings of the consortium members, staff development workshops, orientation sessions, and program related activities at several program sites (Richard J. Daley College, San Antonio College, Polytechnic University, and Turabo University). The observer used a structured protocol to ascertain the extent to which activities were conducted as represented in program materials (correspondence, minutes, agendas, brochures, etc.); the correlation between topics presented and relevance to program participants; and the collaborative aspects of the consortium, among others.

The program was externally evaluated annually. In 1998, Barbara R. Sjostrum, was the evaluation consultant and in year 1999 and 2000, María de los Angeles Ortiz from Ortiz, Lord, Hope & Associates conducted the external evaluation. At the end of each year of operation a discrepancy analysis was conducted between the activities proposed at the request for funding and those actually implemented.

In addition to the above strategies for outcomes assessment and evaluation, the evaluation consultant, Dr. Ortiz, conducted personal interviews "on site" with, Dr. Mark D. Warden, President of Richard J. Daley College, Dr. Delores Fernandez, President of Hostos Community College, Ms Miriam Cruz, President of Equity Research Corporation, and various administrators at the sites, both in the U.S. and in Puerto Rico.

NHBEP's Outcomes

The following section reports on the NHBEP's outcomes, based on a review of documentation and data including meeting minutes, agendas, announcements, curricula developed, recruitment strategies/activities, site visits, networking/coordination, articulation agreements,

policies developed and students registration documents at the various sites. All of these data will be reported as they pertain to the twelve specific objectives of the NHBEP. The documentation and outcomes of the NHBEP indicate a high level of activity and performance for the three years of implementation of the Project.

OBJECTIVE #1:

TO HOLD A SERIES OF MEETINGS OF MEMBERS OF THE CONSORTIUM FOR PURPOSES OF NETWORKING, COORDINATION, AND STAFF DEVELOPMENT

Numerous meetings (fourteen) were held at the national office of the NHBEP and on site at all consortium institutions. Data from quarterly reports submitted by consortium coordinators (or acting coordinators), indicated that the first few months of the project were devoted to continuous meetings with administration, faculty, student development personnel, advisory committees, search committees, curriculum committees and so on. The quarterly reports highlighted the results and the importance of these meetings.

All three meetings covered a myriad of topics outlined in the respective agendas. These were related to preparation for the implementation of the NHBEP vis a vis the recruitment and placement of students. The sessions, for the most part, had a good balance between informational activities and discussion of needs, strategies for implementation and other details of the project. Topics covered included: updates of project, matching objectives between sites and the National

Project Coordinator; action plans, recruitment strategies with local high schools; how to fit all components of the project together; what various sites have to offer incoming students; definition of roles and responsibilities for program personnel; fund-raising and internships; a review of facilities, academic programs and student services at the two Puerto Rico engineering schools; faculty/staff development on grant writing, culturally responsive pedagogy, and administrative issues.

The review of meeting documentation, input from participants and observation data revealed the evolution of a strong collaborative group which formed between the first and second consortium meeting. They knew the details of each other's individual sites, listened and offered solutions to problems within individual sites and so on. From observing the group in both formal and informal sessions, it was clear that the group had developed a strong sense of networking and collaboration. They also indicated by their candid input to the NHBEP personnel, that they felt supported and comfortable when raising important, even though potentially conflicting issues. All interview and survey data reported earlier corroborate these perceptions. In terms of the NHBEP effectiveness and impact, it is evident that this objective was met and surpassed. It is not surprising that this objective was one of two most documented, emphasized and implemented during the first year of operation. Furthermore, this objective was the one most noted by

site coordinators as having a major impact on the implementation of the program at their own institutions.

OBJECTIVE #2:

TO CREATE A NHBEP ADVISORY BOARD AT EACH PROGRAM SITE

The San Antonio College was the only institution to have a NHBEP advisory board in place since the first year of operation. The other sites did not complete the appointment process. It is fair to say that a variety of external forces such as: turn over among the coordinators, resignations, promotions, dismissals or mobility among college Presidents and consequent changes in staff at the colleges competed dramatically with the site coordinators' intention to complete the process of appointment of the respective Advisory Boards.

OBJECTIVE #3

TO HAVE A PROGRAM COORDINATOR APPOINTED AT EACH OF THE INSTITUTIONS IN THE CONSORTIUM

All consortium sites developed coordinator job descriptions for their individual sites during the course of the first year. The appointment of a program coordinator at the sites was a highly complex dimension of the programs' functioning for a variety of reasons beyond program control (e.g. administrative structures, discipline specific boundaries, priority given to the NHBEP at each community college, identification/selection of staff at individual sites and change over of coordinators). In some cases, the institutions gave highest priority to the

program and hired someone immediately with full time responsibility to the program. In most instances, positions were split, personnel were given peripheral responsibility in the NHBEP in conjunction with their "regular" job duties, and/or numerous administrative changes occurred within the first year. All of the institutions had changes at the presidential/provost levels. The administrators who left were fully committed to the NHBEP and to the support of the site coordinator.

Another phenomenon which made consistency at some sites difficult for NHBEP was that in two instances highly competent and dedicated coordinators were recruited for higher administrative positions either within their institutions or elsewhere and left before the first year was completed. New, competent coordinators replaced them but had to be briefed about the program without the benefit of the networking/coordination/planning meetings where much of the logic and logistics of the implementation were discussed and decided.

In spite of the changes and obstacles at individual sites to getting the program off the ground, the administrative structures were finally in place and operating smoothly. Therefore, we can attest to the NHBEP's accomplishing the above objective.

OBJECTIVE #4

TO COORDINATE FUND RAISING, THE PROCUREMENT OF OTHER GRANTS OR PARTICIPATING IN ALREADY EXISTENT GRANTS AT EACH OF THE INSTITUTIONS

The NHBEP spent a lot of its energy during its three years in seeking supplemental funding for students enrolling in the engineering programs in Puerto Rico. A number of small corporate sponsorships and/or grants were acquired and the NHBEP procured internships for four of the six students from San Antonio College who started their engineering programs in Puerto Rico in 1998. In addition, personnel at some of the consortium sites acquired additional funding for the support of their students. Hostos Community College and LaGuardia were diligent and effective in supplementing support for their students to attend the "Bridge Program" in Puerto Rico in July 1999.

Through the leadership and the support of Equity Research Corporation, the consortium was successful in the procurement of a **Minority Science Improvement Program (MSIP)** grant, to improve the chances for the academic success of pre-college and college minority students in "gatekeeper" science, engineering and math (SEM) courses. San Antonio College administers this program. The project, **Working in Teams to Enhance the Pre-Engineering Curriculum**, brought together teams, which included faculty from four NHBEP community colleges and

two universities, high schools SEM teachers from feeder high schools, and experts in SEM content, educational technology, and multi cultural pedagogy. Teams selected SEM topics from among the gatekeeper courses and developed instructional modules to enhance the SEM curriculum and thereby the progress of minority students.

The NHBEP also collaborated with several other science, mathematics, and technology projects at NHBEP institutions which serve as a pool for potential NHBEP students in the future. The NASA - **Equity Alliance for Global Engineers Grant**, provided Polytechnic University with funds to develop an engineering students language proficiency and technological skills summer program that will assist participating students to compete effectively in the global context.

Equity Research Corporation secured additional technical support from Sandía National Laboratory, and from other sources for curriculum development at Luna Vocational Institute.

OBJECTIVE #5:

TO COORDINATE BETWEEN HIGH SCHOOLS AND COMMUNITY COLLEGES IN THE UNITED STATES AND ENGINEERING PROGRAMS IN PUERTO RICO TO RECRUIT, TRAIN, PLACE, AND RETAIN HISPANIC STUDENTS FOR THE PROFESSION OF ENGINEERING

This objective, more than any other, generated extensive data during all program activities and events. There is a lot of information addressing this objective and in all documentation reviewed, this was the primary aim and concern

of all involved with the program from the administration to the students. All quarterly reports cited numerous examples of recruitment strategies and materials (e.g. brochures, videos, kick-off activities, press releases, fairs, video conferences, banners, posters, orientation trips and materials, related programs, career advising workshops, seminars with practicing engineers, the creation of the NHBEP web pages, meetings with students associations).

Recruitment and placement of students were primary objectives of the NHBEP. Site coordinators reported contacting a range of 2000 students from local high schools and their own institutions for recruitment purposes. Given the fact that many of the targeted students are just entering the community colleges or currently enrolled in pre-engineering programs in those institutions, it may take, at least, four more years to have a significant impact on the numbers of bilingual engineers. In the first year of the Project (1998), six students have enrolled in the engineering programs in Puerto Rico and other sites reported a range of two to eight students per site who agreed to participate in the NHBEP upon completing their two years in the community/vocational schools. Forty High School Upward Bound students at City Colleges of Chicago participated in a two (2) weeks Summer Program in Puerto Rico to learn more about Engineering, Puerto Rico and the possibility of becoming a bilingual engineer. In addition, six students from one of the NHBEP sites accompanied by faculty members from their community college (Hostos) went to

Puerto Rico to visit and inform themselves about the program and curriculum articulation in the very first year.

The coordinators at Turabo University and Polytechnic University worked together with the staff at ERC to develop a single program application for the two institutions. Other forms were developed as well, including the Application Checklist; NHBEP Students Privileges and Responsibilities Forms; the Transcript Release Form; and a hypothetical financial package available at the two universities of Puerto Rico.

Richard J. Daley Community College developed, in collaboration with San Antonio College, a Coordinator's Source Manual that provided recruitment strategies information.

Pre-selection interviews were conducted in most of the sites for the Summer Bridge Program at Turabo University in the summer of 1999.

OBJECTIVE #6:

TO DEVELOP AND IMPLEMENT PROCEDURES FOR THE TRANSFER OF CREDITS FROM THE U.S. INSTITUTIONS TO THE ENGINEERING PROGRAMS IN PUERTO RICO

Both engineering programs in Puerto Rico and four stateside institutions (San Antonio College, Hostos Community College, LaGuardia Community College, and Richard J. Daley Community College) developed procedures and checklists for transfer from the consortium institutions in the United States into the engineering programs. In addition to developing the procedures, orientations, and informational meetings about these procedures were held in Puerto Rico. At that time, personnel

from the registrars' office of both institutions in Puerto Rico met with the NHBEP consortium members, collectively and individually. They also reviewed transcripts brought by site coordinators. San Antonio College and Hostos Community College restructured their pre-engineering programs models sheets to reflect articulation with the pre-engineering programs and the two engineering programs in Puerto Rico. Polytechnic University was proactive in preparing course to course equivalencies and in awarding transfer of credits following ABET criteria. They performed equivalency tables for students from Richard J. Daley Community College, Hostos Community College, Luna Technical, San Antonio Community College, and LaGuardia Community College, as a very first step in the development of Articulation Agreements among the sites.

At the end of the third year of the Project (2000), Articulation Agreements among the engineering schools in Puerto Rico - (Turabo University and Polytechnic University) and most of the participating community colleges in the United States have been fully developed and signed by all parties.

In spite of all the efforts, it is still a concern the large number of courses (credit hours) that the students have to take at Polytechnic University in order to complete a degree. In addition the students are not happy with the limited number of credit that they can transfer from their colleges.

OBJECTIVE #7:

TO DEVELOP AND IMPLEMENT ORIENTATION AND PREENTRANCE ACTIVITIES FOR POTENTIAL CANDIDATES FOR NHBEP IN THE U.S. AND PUERTO RICO

Orientation and pre-entrance activities were abundant both at the sites in the United States and in preparation for receiving students at the two engineering schools in Puerto Rico. The institutions in the U.S. that recruited students, for Turabo and Polytechnic University held several orientation activities, including group and individual meetings with parents and family, mentors, and potential NHBEP candidates. They also held farewell celebrations which were co-sponsored by university administrators, banking, and other corporate industry from the surrounding community, and the office of the Governor of Puerto Rico. Other activities, including fairs, were part of this process. Several pre-entrance and orientation sessions were also held at all of the five NHBEP community colleges. In Puerto Rico, each of the two engineering schools held two days of tours of their facilities, meetings with personnel across all areas of academic and student life, and a general orientation about the island and the university.

In spite of extensive efforts on the part of the NHBEP administration and site coordinators, this objective was always a challenge because of the students' expectations, which frequently went beyond the scope of the NHBEP activities and services. As expected, the transition to study in another country and culture was difficult, especially for young adults or students with family responsibilities.

OBJECTION #8:

TO REVISE/DEVELOP APPROPRIATE CURRICULUM AT THE COMMUNITY COLLEGES TO FACILITATE THE PREPARATION AND TRANSFER OF THEIR STUDENTS TO ACTUAL ENGINEERING PROGRAMS IN PUERTO RICO

Considerable preliminary work was accomplished in terms of curriculum revision/development. At each of the consortium meetings, each coordinator brought and exchanged their institution's college catalogue. They presented their own existing program requirements and reviewed and discussed one another's. They exchanged ideas as to pre-college courses to be taken during the high school years, as well as what the community college curriculum should contain for an engineering-bound student.

At one of the meetings in Puerto Rico, faculty from the engineering schools met with faculty/site coordinators from the U.S. feeder institutions to discuss curricular needs to better prepare students to come into the engineering programs. Hostos Community College, which did not have a pre-engineering program as an academic offering has structured and developed one as a result of the NHBEF students needs and the working meetings; this is a major accomplishment. Also course modules have been developed to enhance mathematics and other pre-engineering skills.

Curriculum is a primary targeted objective now that the project has been implemented with the first group of students. It is a known fact that the students' achievement and curricular choices upon entering high school influences their subsequent opportunities to enroll in various mathematics and science courses.

Typically high achieving students who plan to attend college enroll in academic curricula that require them to take more math and science courses than other students and to take courses that cover advanced concepts and processes. Four of the participating community colleges do not offer advanced physics courses that are Calculus base, which is a pre requisite for the engineering courses at the senior colleges.

Of great concern is the development of a curricular model that would span from middle school, through high school, the community college to the engineering school. The differences in program offerings among the participating institutions, with only one having pre-engineering program (and another with a recently designed one) makes it harder to implement common recruitment and retention strategies. The gaps in the curriculum remain a challenge for the NHBEP.

OBJECTIVE #9:

TO DEVELOP OPPORTUNITIES FROM PROGRAM PARTICIPANTS TO DEVELOP THEIR BILINGUAL LINGUISTIC SKILLS WHILE BECOMING ENGINEERS

This objective has been addressed at the planning/coordination meetings and through the already existing curricula, as well as the revision/development of additional curricula at the NHBEP institutions. All of the community/vocational colleges teach the majority of the curriculum in English with the exception of Hostos Community College in New York City which, by charter, is a bilingual institution with curricula in both Spanish and English. The other four community

colleges offer English as a Second Language (ESL) as well as Foreign Language courses in Spanish. One of the challenges for these institutions is that frequently the ESL courses are not credit bearing and are treated as remedial. Presently, the City of New York (CUNY) system is debating this issue and the Hispanic serving institutions (LaGuardia Community and Hostos Community Colleges) are fighting to maintain these courses as credit-bearing in the way in which foreign language (Spanish) generates college credit. This debate will continue to affect adversely the financial aid available for ESL and Spanish as a Second Language (SSL) students.

The two engineering universities are Hispanic Serving Institutions, by definition, given the target population they serve. In addition, they both have as a mission the development of bilingual engineers in preparation for worldwide globalization and the technological revolution. What is unique for the NHBEP participants is that one engineering school uses English as the primary language of instruction and Spanish as the second language while the other one uses Spanish as the primary language and English as the second language. Based on the entering student's language dominance and proficiency, he or she is matched to one of the two institutions. Polytechnic University offers its curriculum in Spanish and Turabo University in English. In either case, the students are exposed to a bilingual environment because all of the textbooks and materials used for engineering are in English and their professors have also studied the content in English. At the same time, much of the discussion, study groups, and general linguistic norms within the

institutions are primarily in Spanish. The consortium has a unique potential for promoting linguistic skills in both languages since students are exposed primarily to one language in the United States and another in the Puerto Rican society. Furthermore, although one language predominates within the context of the country in which students are studying, both languages are used in multiple settings (home, social events, cultural events, etc.) so that students are immersed in bilingual environments. In addition, program students were exposed to language tutorials during the summer of 1998.

The NHBEP made significant strides in achieving its objective of developing opportunities for the development of bilingual linguistic skills in Spanish and English during its first year. This objective was a major focal point for the project's second and third year of funding now that the recruitment procedures and engineering content have been developed and implemented.

OBJECTIVE #10:

TO ASSIST PROGRAM PARTICIPANTS (STUDENTS) IN ACQUIRING FINANCIAL AID PACKETS AND SUMMER INTERNSHIPS

The above objective was one of the most important ones to both the recruitment and placement of students in the NHBEP. It is the single most cited area of concern on the part of students and individual site coordinators. It required extensive communication between the National Office and the five stateside sites throughout the entire first year of operation. Institutions in Puerto Rico worked

together with the National Office in providing the best possible financial aid packages for potential students. These included: (1) the federal aid assistance program; (2) academic scholarships offered by both universities; (3) competitive academic fellowship and scholarships offered by the individual states where the student resides such as New York, Texas, Illinois, and New Mexico; (5) internships, work-study at the prospective institutions; (6) achievement awards; and (7) potential for any and all funding sources available to college and university students in the United States.

In terms of internships, during the summer of 1998, six Puerto Rico bound students from San Antonio College participated in summer internships acquired by the National Office for four of the students and by the site coordinator for the other two. These internships included a weeklong orientation in Washington, DC which were coordinated and paid for by the NHBEP. Activities included: (1) tutoring in Spanish language skills for those staying in Washington for the summer, provided by a member of the Pilar Barbosa Summer Internships Program of the Legislature of the Commonwealth of Puerto Rico housed at ERC for the summer; (2) an orientation regarding living and studying in Puerto Rico; (3) readings and discussions on contemporary Puerto Rico; (4) workshops on time management; (5) visits to federal agencies and meetings with Hispanic government officials; (6) visits to cultural sites and events in Washington, DC; and (7) networking with other Hispanic professionals (engineers) working in the capital region.

The NHBEP students were placed in internships in Washington, DC arranged by the NHBEP National Office with the U.S. Department of Labor, the Environmental Protection Agency, and the MARCH. In addition, two students were placed in the Center for the Advancement of Hispanics in Science and Engineering Education in Texas. These two internships were arranged by the site coordinator at San Antonio College. Overall, the arrangement and funding for the internships were important elements of program implementation because they helped students financially for underwriting their participation in the NHBEP and exposed students to the professions, particularly science, mathematics, technology, and engineering.

The internships also provided an experience away from home which helped prepare students in the necessary skills for study abroad. Recruiting and placing the students took a lot of written correspondence, seeking locations and networking.

As is the case with all groups who are the first to pilot an innovative program, there were several logistical difficulties cited by students regarding the expenses, living arrangements, and so on, however, everyone interviewed (project director, site coordinator, students) was satisfied with having been able to obtain internships within such a short time frame.

There was no student participation in internships during the summer of 1999.

After critical and profound analysis it was decided to develop a "Bridge Program" at Turabo and Polytechnic University, for those students planning to pursue a career in engineering at any of the two institutions in Puerto Rico.

The "Bridge Program" started on July 16, 1999, with the participation of fifteen students. Ten out of the fifteen students were at Turabo University enrolled in the course - **Introduction to Engineering**. The remaining five students were at Polytechnic University enrolled in a course similar to **University Life** with a heavy emphases in engineering.

The design, implementation, and logistics of the "Bridge Program" were found to be excellent. The students expressed satisfaction with the academic program and with the cultural and social activities that were programmed for them. The coordinators provided advise and counseling in issues related to financial aid and housing information. In general the "Bridge Program" provided an interface and a smooth cultural transition for those students that finally decided to stay in Puerto Rico.

Financial aid issues were addressed properly by the NHBEP National Coordinator. Two workshops on funding were offered to the site coordinators; one entitled "Show me the Money" and another on "Grant Writing", however the financial needs of the students and their expectations were by far higher than the NHBEP's capacity to satisfy them.

Almost half of the students at the Bridge Program were married and had financial and personal obligations. These circumstances challenged their opportunities to stay in Puerto Rico unless a strong support (economic and personal) was provided throughout their studies.

OBJECTIVE #11:

TO PROVIDE STAFF DEVELOPMENT FOR SITE PROGRAM COORDINATORS AND PERSONNEL IN THE AREAS OF STUDENT DEVELOPMENT, GRANT WRITING, CURRICULUM

Throughout the three years of operation, the NHBEP conducted extensive staff development during a series of three planning/coordination meetings which took place in February (Chicago), March (San Juan, Puerto Rico) and July (San Juan, Puerto Rico). All data indicated that the sessions were a success and helpful in facilitating program objectives. A sample of workshops included: "Culturally Responsive Practice: Insuring Program Success," presented at Richard J. Daley Community College (February 1998); "The Role of the Program Coordinator: Network for Program Success," Richard J. Daley Community College (February 1998); and Grant Writing, San Juan, Puerto Rico (March 1998). In addition to these sessions, a number of in-service activities were conducted at the individual program sites especially related to program exposure and the objective of recruitment and placement of students. For example, San Antonio College held a video conference and a fair related to introducing the NHBEP. The institutions in Puerto Rico also held numerous in-service sessions on the topics of financial aid, transfer validation, orientation to the institutions, support programs such as STEP and so on throughout the three years of funding.

The outcomes related to this objective are particularly noteworthy, since many staff development activities took place and were cited as helpful in the opinion of the NHBEP at the seven consortium sites.

OBJECTIVE #12:**TO DESCRIBE THE NHBEP'S PLANNING, IMPLEMENTATION, EFFECTIVENESS, AND IMPACT AS A MODEL WHICH COULD BE REPLICATED FOR OTHER TARGET CAREERS AND POPULATIONS**

Part of this last NHBEP's objective overall goal is to provide information and data which would describe the NHBEP in such a way that it could be replicated as a model for use with other professions seeking to recruit and place bilingual individuals and Hispanic students or other groups of students in either Engineering or other professional fields where they are presently critically under represented (e.g. law, architecture, medicine). In order to accomplish this objective, the evaluators have collected and analyzed all data regarding the NHBEP's planning, implementation, and impact on the consortium institutions, in general, and the program's students, in particular. The presentation of a model for replication required a review of all program documents, including proposals, brochures, correspondence, agendas, minutes, and products developed during the three years of operation.

During March 1998, a preliminary overview of the NHBEP and the model for replication was presented at the American Association for Higher Education (AAHE) annual national conference. This session was co-sponsored by the Hispanic Caucus and the Community College Network of this organization. The presentation was entitled: "A National Hispanic Bilingual Engineering Model: A

Constructivist Approach to Community College/Professional Education Articulation.” The NHBEP was showcased and preliminary information on the model was presented by the program consultants, the NHBEP National Director, and two members of the consortium, the Vice President/Provost from Turabo University in Puerto Rico and the Assistant Vice President for High School Recruitment and Community Liaison as well as the Acting NHBEP Coordinator for Richard J. Daley Community College in Chicago, Illinois.

The above outcomes data reported by objective, reveal the overall effectiveness of the NHBEP activities related to the planning, coordination, recruitment, and retention of Hispanic engineering students. As a result of these efforts, there are four students currently enrolled in the two schools of engineering in Puerto Rico. At the time this report is being written there are commitments from other students to enroll at Polytechnic University and Turabo University in the second semester of the academic year 2000-2001.

This includes a new component being added to the program composed of former engineering students from Latin America who reside now in Chicago and are presently enrolled in ESL programs at Richard J. Daley Community College. Candidates from this group will transfer to Puerto Rico in January 2001.

The student actual enrollment in the engineering schools demonstrate that the NHBEP model works. However as a “new creature” it has its shortcomings, including the need for a stronger and more consistent support from the top

management (Presidents and Chancellors) of the participating institutions. In the next section, **The Development of a Model** more specific comments will be made.

VII. THE DEVELOPMENT OF A MODEL

Hispanics remain under-represented in science and engineering. In the United States they made up 11 percent of the college age population, but earned not quite 5 percent of science and engineering degrees; however, their representation has increased markedly. Hispanics earned 55 percent more bachelors degrees in science and engineering in 1991 than in 1977. Over the same period of time, the number of science and engineering bachelors degrees awarded to groups not under-represented in science and engineering remained relatively constant overall. Although the number of science and engineering bachelor's degrees awarded to Asians more than tripled, the number of degrees awarded to whites decreased by 6 percent (Indicators of Science and Mathematics Education, NSF, 1996).

There are some important considerations that are key to the recruitment of Hispanic students for the engineering careers that transcend the NHBEP structures. These include the nurturing environment that have been provided in most of the participating institutions; the extraordinary recruitment and coordinating efforts that the people involved have given to the NHBEP; and even the motivation, interests and performance of students. However, scholarships and stipends to cover tuition

and living expenses are among the most critical issues if we are going to retain students in Puerto Rico until they graduate.

It is fair to say that most of the highly motivated students that attended the "Bridge Program" in Puerto Rico are not "traditional students". Only three were in the age bracket of 17-20 years old, seven of them were 21-29 and five were over 30 years old. Seven were either married or divorced, and two had small children. Prospect students expressed great interest in the Program. Most of them were excited to become bilingual engineers, however for those married and/or with children and with contracted financial responsibilities; relocation, getting a job for their spouses, and even day care issues, were factors critical for success in their studies that we could not handle.

Some of the students were working while studying in the States, needing that extra income for their living expenses. Although they did not expect that all their expenses be covered, they expressed uncertainty in terms of how tuition and basic needs will be covered without a scholarship or a stipend in addition to the Pell Grant and the small stipend from the program. Even though tuition costs at Polytechnic University and Turabo University are considered low by United States standards, the Pell Grant is not sufficient to cover all their educational and living expenses.

Given these considerations; after three years of the NHBEP implementation and three external evaluations there is sufficient data to refine and reshape the Model as it reaches maturity and readiness for replication. Two of the mainland

community college and the two Schools of Engineering have agreed to institutionalize the program in their respective campuses. Equity Research will assist them as they work to achieve this goal.

Proposed Actions for the Replication of the Model

1. Recruitment of the Students:

1. Concentrate on high school Hispanic students (grades 10, 11, and 12) and start working with them through a Saturday Academy - sponsored by a Community College. Provide curricular units (mini-courses) in **Spanish and English language, calculus - base Physics, Information Technology and Pre-engineering.**
2. Recruit students from Community Colleges already enrolled in pre-engineering programs. Students must be in "good academic standing", be proficient in one of the two languages and highly motivated to learn a second language; some course work in the second language is highly recommended. Assessment of language proficiency should be mandatory.

2. Institutional Support - Engineering Schools

- 2.1 Establish a Scholarship Fund at each engineering school. Fund raising from local corporations, business, and industries, funds from other federal sources and institutional funds can be used to support students while they are studying in Puerto Rico.
- 2.2 Appoint a mentor to each of the students enrolling in the engineering programs at the institutions in Puerto Rico.
- 2.3 Provide the opportunity for the students in their second and third year of studies in the engineering schools to participate in corporate internships during the Summer.

- 2.4 Assess periodically the second language proficiency of the students in the NHBEP and provide opportunities for them to become truly bilingual.

3. **Curriculum and Programs Articulation**

- 3.1 Establish the “Bridge Program” as a permanent component of the NHBEP model.

This highly structured Summer Program will provide challenging academic, cultural, and social activities for prospect students, already qualified for admissions at any of the two engineering schools in Puerto Rico. The program should include a credit bearing course in engineering, and the opportunity to earn a stipend to cover their educational expenses.
- 3.2 Adopt an articulated curricular model that would span from high school, through the community college to the professional engineering school, or from high school through engineering programs.

4. **Administration and Coordination**

- 4.1 Provide extensive professional development in program management and fund raising to site coordinators.
- 4.2 Let the engineering institutions design and deliver an intrusive recruitment of candidates among high schools and community colleges in the United States with a high concentration of Hispanic students. Admissions information, applications, financial aid institutional profiles and other relevant information should be included in the NHBEP web page.
- 4.3 Allocate funds for recruitment, mentoring, and scholarships at the engineering schools and allow local control over budgetary issues.

- 4.4 Equity Research Corporation should keep the important role of monitoring, evaluation, and assessment of outcomes of the Project. It must also monitor the financial management of the NHBEP.

VIII. CONCLUSIONS AND MAJOR ACCOMPLISHMENTS

In summarizing project outcomes for the National Hispanic Bilingual Engineers Program during its three years of funding 1997-98 to 1999-2000 is valid to report that **the data analyzed, including review of documentation, surveys, interviews, focus groups, and observations, revealed a pattern of effective implementation of the NHBEP's project objectives.** In particular, the NHBEP was highly successful in its objectives related to planning/coordination, networking, orientation for potential and enrolled students, staff development activities, curriculum revision/development in the areas of bilingual language skills and engineering content, and a description of the process and products for the development of a replication model.

According to these data, the NHBEP has met all of its objectives outlined in the original proposal for funding. Most of the Consortium site coordinators consistently reported that they felt the personnel at the National Office was supportive, creative, and open to suggestions for implementing the program. Furthermore, they felt the planning and coordination meetings were highly successful in creating collaborative approaches to achieving program objectives.

Major Accomplishments:

Following are the highlights that surfaced from the data collected during the three years of operation of the NHBEP.

Contacted approximately 2000 students across the five U.S. sites to inform them of the existence and relevance of the NHBEP and to recruit them;

- Placed six students from San Antonio College in Turabo (3) and Polytechnic (3) Universities in September 1998, placed one student from Hostos College at Polytechnic University during Fall 1999 semester, placed two students from San Antonio at Turabo University during Fall of 1999 semester, and placed one student from Hostos College during Fall of 2000 semester;
- Five students will be going to both Turabo and Polytechnic during Winter 2001 semester;
- Obtained four summer internships in Washington, DC and two in Texas for students enrolling in the engineering programs at consortium institutions in Puerto Rico;
- Prepared and disseminated program brochures, banners, and videos for recruitment/orientation purposes;
- Held a series of staff development workshops on fund-raising, culturally responsive pedagogy, and administrative procedures;
- Revised, and in two cases, developed pre-engineering curricula for community colleges in the United States, thus aligning the pre-engineering program with that of the professional engineering school;
- Obtained scholarship and financial aid for NHBEP students enrolling in the engineering programs at Turabo and Polytechnic University;
- Established advisory committees at one NHBEP consortium site and started process for establishing advisory boards at other sites;
- Established links with other projects related to mathematics, science, and technology (NASA, STEP, MSIP) in the NHBEP Hispanics-Serving Institutions;
- Developed Articulation Agreements among all of the community colleges in the United States and the two engineering schools in Puerto Rico;
- Significant advances towards the consolidation of a National Engineering Educational pipeline through the consortium;
- Development of the conceptual framework to advance the institutionalization of the Project;
- Commitment and support from the presidents/provost of Hostos Community College, Richard J. Daley College, Polytechnic University, and Turabo University for the institutionalization of the NHBEP;

- A promotional presentation at the **White House Initiative on Educational Excellence for Hispanics Americans**, regional meeting in Chicago, Illinois;
- Reaching out to other organizations with similar educational objectives such as ASPIRA, and seeking corporate sponsorship with corporations such Lucent as in Chicago;
- Organization of a Round Table on Strategies for Bi-literate Work Force held in Washington, DC, with the participation of public and private organizations to explore possible partnerships and internship opportunities for bilingual/bi-cultural students in different professional careers.

IX. CHALLENGES AND OBSTACLES

Data indicated that there were some logistical problems in implementing the NHBEP. These seemed to be the kinds of problems that surface when implementing any new program. Particularly, problems occur when you are developing an innovative program comprised of multiple institutions of higher education and geared to preparing a cadre of professional engineers from an historically under represented group, in this case, Hispanics. The Project, in and of itself, is ground breaking and one of a kind. It will need to run for several years before the first group of students can provide feedback regarding the effectiveness and impact of the NHBEP. However, as with any "new creature", revisions and improvements are a constant agenda item. At times, the continuous inquiries and challenges on the part of the students and scrutiny within the consortium institutions were burdensome specially to the coordinators. The students also wanted prepackaged and instant responses.

One of the challenges cited by some coordinators was the lack of local support within their own institutions in giving the program priority and resources. This seemed to be caused in part by changes in the administration at all of the community colleges. Another explanation comes from a lack of a pre-implementation planning year. A planning year would have allowed for pre-

service training. In turn, all would have begun with the similar notions and understandings of the program objectives, goals, limitations, and so forth.

A major challenge for the NHBEP was a series of changes in personnel at most of the sites which changed the composition of the planning/coordination group and created a need for constant "catch up," addressing issues that had already been addressed or decided, and briefing new personnel throughout the length of the project. Although the new personnel were highly qualified and dedicated to the NHBEP, these changes necessitated a lot of time in bringing people up to date with the project, networking within their respective institutions and establishing communication with consortium members and the National Office.

Another challenge dealt with the idiosyncracies of each of the NHBEP academic institutions. For example, the procedures for (1) receiving/dispersing funds, and (2) communicating through the chain of command in the individual consortium sites varied greatly. This diversity of procedures and understandings required extensive communication and troubleshooting on the part of the NHBEP director and staff in the National Office.

Yet another challenge was the fact that the program had not existed in the past. Therefore, the students that were recruited may not have thought of engineering as a career choice early on. The institution may not have had an existing pre-engineering program or curriculum sequence, as a concentration, minor, or major. Some students did not have the required academic courses that are part of a pre-engineering curriculum at the community college. Thus, they were not able to transfer as third year students. This was an obstacle to recruitment. Students did not want to take additional semester of "basic" courses. They wanted to enter into the third year of the engineering program.

Finally, the last challenge which merits comments concerns communication with the students transferring from U.S. sites to the engineering programs in Puerto Rico. This became

problematic at times. The fact that messages traveled through several person before reaching the students also increased misunderstandings and the time factor in getting their concerns addressed. For example, if a student wanted to know the specifics of their financial aid package they first asked their NHBEP site coordinator. Then that person spoke with their institution's financial aid personnel, the NHBEP National Director, their board members or advisory committee, and at times with private funding sources. The National Director communicated with the engineering school administrators to facilitate the process and so forth. Different persons would give varying opinions. Individual understanding varied at time. The person with the authority to answer a specific question was not always available and the students were not always patient listeners.

Easing the transition and adjustment process for students from the U.S. community colleges to engineering programs in Puerto Rico was a highly complex and occasionally conflicting. Some students and site coordinators expressed a need for a faster turn around time in responding to their applications and letting them know definitively how many and which credits were transferred. According to numerous communications between the National Office and site coordinators in the U.S. and Puerto Rico sites, a lot of time and energy was spent in facilitating the transfer process; however, the outcomes were successfully met.

X. RECOMMENDATIONS

Based on data from the National Hispanic Bilingual Engineers Program, including correspondence, quarterly reports from consortium sites, interviews, surveys, focus groups, observations, and outcomes the following recommendations are made:

- (1) Present the NHBEP project findings and consortium model at national and international conferences;

- (2) Focus on the objectives of curriculum, staff development and fund-raising for student expenditures and support services;
- (3) Follow-up through a longitudinal study the NHBEP students enrolled in engineering programs at Turabo and Polytechnic University; survey and interview students who have gone through their second and third year in the engineering programs at Turabo and Polytechnic Universities to determine program impact;
- (4) Conduct a cross-disciplinary lecture series with faculty from foreign languages, science, political science, sociology, etc. at consortium sites to enhance students' knowledge and understanding of culture and cultural context; in a global society
- (5) Prepare program materials/products for national dissemination.