Impact of K-16 Programs at New Jersey Institute of Technology on STEM

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Abstract

Over thirty (30) years ago, faculty at New Jersey Institute of Technology (NJIT) recognized a need to develop programs directed at minority and underrepresented students in the K-12 years in order to introduce them to the areas of science, technology, engineering and mathematics, (STEM). From this humble beginning, numerous programs have been initiated that encompass the K-16 years in education. These programs all have the objective of increasing the minorities and underrepresented population to the STEM areas but each program is directed to different age groups and the approach to achieving these objectives varies.

The student pipeline (K-16) begins with the Elementary Science Outreach Program offered at area schools for K-8 students. It continues with the FEMME programs, which direct their initial attention to females in the 4th grade and continue on with offerings to 5th, 6th, 7th, and 8th graders in STEM fields during a four-week summer course. These programs can be followed by the Upward Bound program for students in the 9th, 10th, and 11th grades or the Pre-college Academy which offers college courses for college credit to ninth through twelfth graders. Both Upward Bound and the Academy are intensive summer and academic year programs.

In the college years (13-16) programs such as Educational Opportunity, Undergraduate Research Experience and the Ronald E. McNair Post-baccalaureate Achievement Program continue the development of minority and underrepresented students in the STEM areas.

To date, all of these programs, and many more of a specific nature, have been highly successful in achieving their goals of developing awareness and recruiting students into STEM fields. Details of the numerous programs at NJIT will be presented.

Introduction and Background

New Jersey Institute of Technology (NJIT) is an inner city urban institution located in Newark, New Jersey with a social, economic, and academically diverse student body consisting of approximately 5800 undergraduate and 3000 graduate students. Currently, the undergraduate population is approximately composed of one-third (women, Hispanic, and black) minorities. The institution has, traditionally for the most part, consisted of student bodies, who were the first in their families to seek a college education.

NJIT was founded in 1881 as the Newark Technical School. At its founding, the founders stated, “The Newark Technical School has for its object in all departments, the advancement of the manufacturing interest of the city, and its course is arranged with special reference to the intellectual wants and improvement of the working classes.” Newark, New Jersey was a hub during the industrial revolution with numerous industries. New Jersey was a great state for many new inventions and Wall Street was only ten miles away. The city blossomed. Its students were the first generation college bound students from the families of European immigrants. In 1919, the school became Newark College of Engineering. For the next almost 50 years it served as a school for first generation college bound students of European immigrants.. By the 1950’s, the economic and social development in Newark had gained momentum as the city prospered. However, things began to change during the 1950’s with the active movement by the black community for equality in deed rather than words. Then in July, 1967 racial violence swept the city. The black neighborhoods were inflamed and the National Guard entered Newark. The once beautiful, prosperous city of Newark became the classic example of the urban blight that overcame many of America’s cities in the aftermath of World War II. Martin Luther King, Jr. had stated something like, “Learn baby learn, don’t burn baby burn”. Simultaneously, immigration patterns changed from Europe to South and Central America and Asia. A new minority joined the black community. It was during the late 1960’s and early 1970’s that the pre-college programs at NJIT began to develop in the Department of Chemical Engineering and Chemistry and Civil and Environmental Engineering as the need was recognized to provide opportunities for underrepresented populations. Key faculty and staff were quickly aware that a need existed for outreach programs to this community and their implementation plan was rapid. Over the last 30-40 years although the ethnic background of the children of immigrants has changed, the school, which became NJIT in 1974, still served as a school for first generation, college bound students. The Center for Pre-college Programs, which started in the Department of Chemical Engineering and Chemistry, became a separate entity in 1988.

Hence, NJIT has a long history of outreach programs for elementary through college level students. The outreach programs developed by the Center for Pre-college Programs currently serve more than 4500 elementary and secondary school students and teachers annually through an array of pre-college programs. The extensive array of programs that have been developed at NJIT over the last four decades will be discussed and pertinent statistics will be presented in this paper. These programs all have the objective of increasing minorities and underrepresented populations to STEM areas, but each program is directed to different age groups and the approach to achieving these objectives varies.

The literature, particularly the American Society of Engineering Education, the Frontiers in Education and the International Conference on Engineering Education proceedings, contains publications from many universities engaged in pre-college programs. Many of these publications have been cited by the authors in previous publications.¹⁻¹⁴

The Programs

The Pre-college Center is dedicated to help schools and school districts in assuring all children the opportunity to learn and to meet the high academic expectations of the standards. Its activities are based on the belief that all children must be given the opportunity to achieve those

skills and knowledge addressed in the content standards. Our instruction provides teachers with the skills and support needed in their classrooms to meet and implement the academic requirements demanded by the NJ Content Standards and the students with access to appropriate STEM education.

Seeking to fulfill the "NCLB"(No Child Left Behind) mandate at the pre-collegiate level and continue to provide participants with access to appropriate STEM education, mentoring activities and peer support, we have systematically organized the Center's programs into several complementary categories.

- Teaching, curriculum reform and standards
- Science and math for access for children with disabilities
- Access to college curriculum through the Pre-college Academy
- Urban outreach
- Women in Engineering and Technology Initiatives
- The Trio Programs
- The Bridge to Engineering Program

Elementary Science Outreach Program

Initiated in 1987, The Elementary Science Outreach Program was developed in collaboration with the Newark Public Schools.¹ STEM graduate students assist teachers with hands-on inquiry science activities in their classrooms once a week. The project has succeeded in helping teachers to change some of their in-class behaviors. For example, after a year in the program, teachers lecture less, implement more hands-on-science activities, and feel more comfortable teaching science.

Many youngsters arrive in upper elementary science classes already turned off to science and have slipshod habits that squelch their natural scientific curiosity. In order to break this chain of failure in science, we have harnessed students' natural curiosity to inculcate the joy of doing science as well as habits of planning, precision and attention – habits vital to their entire school careers.

Teachers, too, have to be charmed by the magic of doing science. Many not only dislike science, but fear it. They fret about unanticipated questions or mishaps and classroom safety. They wonder how they can encourage exploration without promoting pandemonium. Moreover, fourth grade teachers still feel that they, alone, are responsible for preparing children for ESPA (New Jersey's Elementary Science Proficiency Assessment). The lack of curriculum articulation between grades within many schools reinforces this misconception.

The Outreach Program is a systemic approach to improve urban science and math education through the academic and personal development of teachers and students. For teachers, the program demonstrates the usefulness of science in the instruction of math and communication skills and for students the program removes barriers to success by building skills in communications, technological literacy, critical thinking and problem solving. As part of the method, the project focuses on several grade levels within a small number of schools throughout the academic year. Training for graduate assistants (GAs) is conducted prior to sending the teaching associates to the classrooms. The aim is to prepare the GAs to assist teachers in the

classroom with science activities. The training provides familiarity with inquiry science teaching, program guidelines, and classroom expectations. Some of the topics are discussed continually through weekly GA meetings and individual meetings with a program coordinator.

Women in Engineering and Technology Initiative-- FEMME Program

This initiative, designed for elementary, middle and secondary school girls in order to increase the number of women entering and successfully completing STEM careers, is one approach utilized by NJIT to stop the migration of capable and interested students out of the STEM pipeline. Our program builds on existing partnerships in order to produce systemic changes in the attitudes, behaviors, academic preparation and performance of female students.

First offered as FEMME in 1981, the initiative was designed to improve the mathematics and science backgrounds of academically talented 9th grade girls and encourage them to pursue STEM careers, it provided four weeks of intensive and rigorous academic activities in environmental science, engineering, mathematics, architecture and computer science. In 1993, funding from the National Science Foundation (NSF) gave the opportunity to include fourth through sixth grade girls.

Currently the project is fully institutionalized at NJIT and offers 150 high-ability fourth through tenth grade female students a four-week summer experience and academic year workshop sessions during the school year. The FEMME programs have reached over 1,500 girls, encouraging them to pursue appropriate careers. Our assessment of project outcomes indicates that over 60% of our alumni embark on STEM education and careers which is well above the national average. The structure of the program and its objectives, classroom discussions, lectures, laboratory experiments and demonstrations, homework, projects, mentoring sessions, and field trips are specific to appropriate grade course work.

To accomplish a true academic continuum, a main thematic unit that is aligned with the New Jersey Core Curriculum Standards was created for each group that links all other subjects and activities. Each unit and academic curricula follows the Standards for appropriate grade levels and provides students with prior knowledge upon which we can build. FEMME groups and their thematic focuses are:

- FEMME 4—Environmental Science
- FEMME 5—Aerospace Engineering
- FEMME 6—Mechanical Engineering
- FEMME 7—Chemical Engineering
- FEMME 8—Biomedical Engineering
- FEMME Academy—Electrical and Computer Engineering

The Femme Academy is an intensive one-week residential summer experience, which is designed for female students completing their sophomore or junior years in high school. The program increases girls' awareness of educational options in STEM while encouraging their exploration of those fields. Students work with faculty members, women engineers, and are assisted by engineering students in hands-on design challenges. Other highlights include site visits to industry, computer activities, panel discussions, field trips, and a family celebration

where students have the opportunity to present their projects to their parents and peers. Participants will leave the program with concepts that will strengthen their math, science, analytical, problem solving, and communication skills. The disciplines covered are aeronautical, biomedical, chemical, environmental, electrical, civil, computer and mechanical engineering.

Programs designed to encourage and attract young women to STEM need to combine interventions that enhance students' sense of self-efficacy and introduce them to scientists and engineers as problem solvers who utilize scientific and engineering principles to help improve people's lives. This line of inquiry has had important implications for removing some barriers that prevent women from pursuing careers in STEM fields.

All participants are tracked every two to three years in order to determine:

- ✧ students' progress in upper grades
- ✧ choice of courses
- ✧ personal development
- ✧ choice of institution of higher education
- ✧ career choice.

The most recent long-term follow-up study of 700 FEMME alumni that was completed in 2002 elicited 685 responses. The survey indicated that 19.1% majored in engineering or technology fields, 36.9% in science, and 10.7% in mathematical fields.

The Introduction to Chemical Industry for Minorities in Engineering Program, ChIME

The ChIME program at NJIT was first presented in 1980 and for the first six years consisted of minority students from high school. The program was initiated by ChIME Inc., (Chemical Industry for Minorities in Engineering), an organization comprised of several key chemical companies who were interested in increasing the participation of minorities in engineering and science.

Subsequently, the focus of the program shifted to the middle school students because it was felt that it could be too late to generate interest in chemical engineering and related areas at the high school level. The program has been consistently supported by a number of chemical companies, the American Institute of Chemical Engineers and the NJIT Center for Pre-college Programs.

The Introduction to Chemical Industry for Minorities in Engineering Program is a four week project designed to give seventh (7th) and eight (8th) grade urban students the opportunity to increase their awareness, understanding and participation in the fields of chemistry and chemical engineering. The program includes formal classroom work, laboratory activities, projects, seminar sessions and field trips. The participants will learn about chemistry and chemical engineering, environmental science, computer programming and applications. About 24 minority students, who are of Black, Hispanic, Native-American or Native Alaskan background, are enrolled in the program. The program generally runs from late June to the third week of July.

Surveys of participants in the program have been conducted over a long period and it has been shown that a large number (greater than 75%) of students pursue careers in engineering or related areas.

TRIO Programs

There are three components to the TRIO Programs. These are the Upward Bound program, Talent Search and Upward Bound Mathematics and Regional Science Center at NJIT. These programs began in 1964 growing out of the Economic Opportunity Act. NJIT first became involved about 1975 and then more intensely in 1988.

The Upward Bound Program is an intensive five-week summer and academic year program, which is designed to provide fundamental support to participants in preparation for college entrance. The program offers opportunities for participants to succeed in pre-college performance and ultimately in higher education pursuits. The Upward Bound program serves high school students from low-income families in which neither parent holds a bachelors degree, and low-income first generation students who are preparing to enter postsecondary education. One goal of the program is to increase the rates at which participants enroll in and graduate from institutions of post secondary education.

The summer component is a comprehensive program that takes place in July and August from Monday through Friday. During the five-week period, students are provided with intensive academics, taking courses in English, math, chemistry, physics, computer science, architecture, space science, French, Spanish, psychology, statistics, and counseling. Classes are taught by NJIT Faculty and local teachers. Students are also given the opportunity to participate in seminars on specific topics offered by community leaders and role models.

The Upward Bound Mathematics and Regional Science Center provides academic enrichment to low income and prospective first generation college bound students to increase the pool of underrepresented groups in the STEM fields. Students are from the targeted areas of New Jersey, New York, Puerto Rico, and the Virgin Islands. One goal of the project is to increase the rates at which participants enroll in and graduate from institutions of post secondary education. The program is designed to

- ✧ prepare students to enroll and successfully complete advanced mathematics and science courses in high school and
- ✧ encourage students to pursue careers in the STEM fields.

The initiative also provides students with personalized college preparation and counseling services. The program generally runs from late June to early August, Monday through Thursday from 9:30 AM to 3:45 PM. Students must have completed 9th grade.

Talent Search Program, a federally funded initiative housed on the NJIT campus, is designed to encourage youths to take and active interest in developing and pursuing academic, career and personal goals. Talent Search provides students with the necessary skills and motivation needed to achieve academic success, graduate from middle and high school, and eventually enter college, trade school, or some form of post secondary training. Middle school students work to prepare for high school and high school students work to prepare for college or a career of their choice. It is the intent of the program to have the student enroll in Talent Search as a 6th grader and continue through the program until high school graduation. Talent Search also provides services to students who are interested in obtaining a GE D (general equivalency diploma), and assists students and young adults with reentering high school or college. The

program is offered during the academic year and during the summer from late June to late July, Monday-Friday, 8:30 AM to 2:30 PM. The program is available to students between 6th and 12th grades.

Pre-College Academy in Technology, Science, and Business

The Pre-College Academy at NJIT is an academic year program for high school students who want to get a jump on their college careers. Originating in 1989 with one course offering in computer science, the program has grown in both size and scope. In 1992 NJIT began offering courses in business management, chemical engineering, chemistry, computer science, mathematics and physics. Having served well over one thousand students, 99% of the Academy's graduates enroll at post-secondary institutions. Eighty percent of these participants pursue STEM education and careers.

Currently, the program is designed for participants to earn college credits in customized classes taught by faculty who have been recognized for their commitment to teaching excellence. During the fall and spring semester the courses follow the regular academic semester calendar and are conducted on Saturdays for convenience to the pre-collegiate audience. During the summer, participants can earn up to eight credits and the program is offered Mondays through Thursdays from late June until the first week of August. At the end of the Academy, grades are recorded on an NJIT transcript. Course credits can be applied toward an undergraduate degree at NJIT and at other colleges and universities.

Students who demonstrate superior academic ability, intellectual curiosity and maturity are encouraged to apply for admission. Marketing of the program is achieved via direct mailings to students, contact with area school districts, and presentations at professional meetings and conferences. The students must complete an application, submit a copy of their high school transcript, submit a letter of recommendation from their guidance counselor, principal or other appropriate school official, submit a copy of their PSAT, SAT or other standardized testing scores and an application.

As a Pre-college Academy participant during the summer, students have the option of living in one of NJIT's modern, air-conditioned residence halls, arriving Sunday night of each week and leaving on Thursday evening or Friday morning. Specially trained resident assistants are available both in the dorm and in classrooms to assist students in the transition to university life and to serve as mentors and role models. For many pre-college students, residence on a college campus serves as the determining factor in their decision to enroll in and attend a post secondary institution. Classes are held in the mornings and afternoons. A mid-day break enables the student to pursue special interests such as athletic and recreational activities, career explorations and library and laboratory research. The students also learn from other talented high school students and are exposed to a scholarly, multicultural, urban university experience. Additionally, workshops in financial aid, the college admissions process and other pertinent topics are offered to students and their families.

The Urban/Civil Engineering Summer Institute

The grandfather of all NJIT pre-college initiatives (formerly called the Urban Engineering Program), the Urban/Civil Engineering Summer Institute (UCESI) is a five-week program

designed to provide participants with a unique exposure to the profession of Civil Engineering. Began in 1970 by a group of NCE (Newark College of Engineering) faculty who offered twenty-five Central high school students a unique opportunity to enrich their educational experience, this project opened the doors for K-12 STEM projects at NJIT.

While the original program has been modified several times, students continue to be introduced to engineering through challenging classroom and laboratory activities. Participants learn about principles of engineering, computer science, computer programming and applications, transportation planning and design, urban planning and architecture, and written and oral communication. The program takes place for five weeks during the summer.

Pre-Engineering Program (PREP)

The Pre-Engineering Program (PREP) is a four-week project designed to provide post-sixth grade students with an introduction to various disciplines in engineering. The program gives students an opportunity to enhance their mathematics, science and technological academic achievement, develop problem-solving and critical thinking skills, and learn about careers in STEM. Through classroom discussions, hands-on laboratory experimentation, computer activities and field trips, participants are introduced to the relationships between engineering concepts and their applications in science and everyday life. Participants learn about engineering, computer applications, mathematics and communication. The program usually runs from late June to late July, Monday –Friday, 9:30 AM to 3:45 PM. Students must have completed the 6th grade.

Explore Careers in Technology and Engineering (EXCITE) Program

EXCITE is a four-week project designed to encourage post-seventh grade students to learn about careers in technology and engineering. EXCITE students will participate in a series of laboratory modules in diverse areas of engineering and technology including Computer science environmental, aeronautical Engineering, Chemical Engineering, Biomedical Engineering and Computer Science.

Students will also receive test preparation training for the Grade 8 Proficiency Assessment (GEPA) test in language arts literacy, mathematics, and science through intensive non-technological approaches to test taking that utilizes innovative methodologies, techniques and strategies that will help students become “smarter test takers”.

Through classroom work, activities, workshops, and field trips, participants will enrich their computer, mathematics, science, and communication skills while increasing their critical thinking and problem-solving abilities. In addition, students participate in ten sessions held on Saturday mornings during the academic year to further enhance students GEPA preparation. The program runs from early July to early August, Monday-Friday, 9:30AM-3:45 PM and 10 Saturday sessions to be held from November to March. Students must have completed the 7th grade

Algebra Prep Program

The Algebra Prep Program (APP) is a four-week preparatory initiative for students entering the eighth or ninth grades who will be enrolling in Algebra I. The program is designed to prepare

these students to successfully complete Algebra I, the cornerstone of the secondary school mathematics curriculum, encouraging them to follow not only the prerequisite mathematics courses, but to choose advanced mathematics and college preparatory courses in high school. The structure of the program includes classroom discussions and lectures, projects, portfolio assignments, homework, learning circles, tests, and field trips. Participants will engage in classes in Algebra I, communication skills and computer applications. Participants will also receive PSAT exam preparation. The program runs from early July to early August, Monday-Friday, 9:30 AM-3:45 PM

Engineering Physics Prep Program.

The Engineering Physics Prep Program (EPPP) is a non-traditional approach to the study of Physics which is designed for students who are considering a career in engineering. EPPP is intended to help students overcome their anxiety about physics, the corner stone of the engineering curriculum, preparing them to succeed in high school physics. The structure of the program includes classroom discussions, lectures, laboratory experiments, demonstrations, projects, and trips. Participants will learn engineering principles, physics, mathematics, geometry, trigonometry and pre-calculus, higher-level problem-solving strategies, computer programming and applications, and written and oral communications. The program usually runs from late June to late July, Monday-Thursday, 9:30 AM-3:45 PM. Students must have completed 10th or 11th Grade and have not previously studied physics.

Gear Up Partnership

Gaining Early Awareness and Readiness for Undergraduate Programs (GEAR UP) Partnership is a federally funded project that partners NJIT and Newark's Camden Middle School. The project provides grade-level cohorts of students with the necessary guidance, skills, and motivation needed to successfully complete high school and enroll in post-secondary education. In addition, the GEAR UP Partnership collaborates with parents, teachers, and school administrators for systemic change and improvement in curriculum and instruction. The program is scheduled from late June to Early August, Monday-Friday, 8:30 AM to 4:00 PM and students must have completed 8th, 9th or 10th grade.

Pre-Engineering and Outreach Program Workshops

The Pre-Engineering Instructional and Outreach Program (PrE-IOP) was initiated in the fall of 2001 to enlarge the future pool of qualified high-tech workers in New Jersey, including those who have been historically underrepresented (such as minorities and women). A collaboration of the Newark College of Engineering of New Jersey Institute of Technology and the Institute's Center for Pre-college Programs, this comprehensive program has two major components. The instructional component, under the auspices of an education and training institute, includes the adaptation and/or development of pre-engineering curriculum modules for use in middle and high school science and math classrooms and the provision of institutes for teacher professional development.¹⁵ The modules are designed to teach pre-engineering skills and integrate science, mathematics, language arts and technology topics and principles that are aligned with New Jersey's Core Curriculum Content Standards. By early 2002, NJIT became the sixth university affiliate of a national pre-engineering program called Project Lead The Way® (PLTW) as another strategy to increase the pool of New Jersey secondary school students interested and prepared to enroll, retain and graduate from

post-secondary, undergraduate engineering-related programs. PLTW trains secondary teachers to implement one middle school and six high school year-long courses. After two years on implementation, the training and education institute has offered four, eight, and ten-day workshops for 147 teachers in PLTW courses, integrated curriculum modules (ICM), or web-based courses from 80 schools representing nearly sixty districts throughout the state during the fall, spring and summer. In addition, 81 teachers from 80 schools have participated in one day workshops.

The outreach component involves the implementation of an “Engineering the Future Outreach” program and the formation of alliances with three groups of stakeholders: educators, counselors and parents to promote STEM careers. Collaborations with STEM professionals and professional associations will strengthen stakeholders’ ability to encourage students to investigate STEM careers.¹⁶ The outreach program uses state-of-the-art multimedia presentations, videos, interactive CD-ROMS, brochures, and teleconferences.

From the fall semester to the spring semester, numerous one day workshops are presented as part of the education and training institute. During the summer a Middle School Teachers’ Institute program involving different courses is presented in 4 or 8 days, from early July to late July with a nominal tuition and a grant subsidy. The same format is used for the summer high school teachers’ institute.

The Undergraduate Research Programs at NJIT

In recent years, undergraduate research has been increasing at a rapid rate.¹⁷⁻²⁰ The web site Engineering Village 2 lists at least 50 very current articles on very specific technical topics used as projects in undergraduate research. The National Science Foundation realizes the importance of undergraduate research and supports these programs through its Research Experience for Undergraduates (REU) program.

Undergraduate research at New Jersey Institute of Technology has been an integral part of the curriculum, as a three credit hour elective course in each of the two senior year semesters, since the 1960’s. The courses have senior level numbers and curriculum integration, but on occasion juniors have been allowed into these courses for credit. In recent years, two other research programs have been made available to the students and in some cases grant curriculum credit. These programs are the Undergraduate Research Experience (URE) Program and the Ronald E. McNair Post-baccalaureate Achievement Program and are designed to recruit qualified students from underrepresented groups and introduce them to the challenges associated with research. The aim of these programs is to foster an interest in the students, who will consequently, continue their education in Graduate School and obtain advanced degrees. The Undergraduate Research Experience (URE) and McNair Post-baccalaureate Research Program have as a goal to encourage undergraduates to perform research and pursue their education to the doctoral level. In addition, the aim of the McNair Post-baccalaureate Achievement Program is to produce more faculties from the underrepresented student body. Undergraduate students who enter these programs gain an insight into the research process, learn about Graduate Schools and learn about an academic career.

The URE Program, which was initiated in 1990, allows students to perform research and independent study under the guidance of a Faculty Advisor. The program provides technical

assistance to Equal Opportunity Program (EOP) and other ethnic minority students and engages them as early as the freshman year in research projects. The program provides counseling, career guidance and mentorship and gives the students the opportunity to present the results of their research. By increasing the number of individuals from underrepresented groups who obtained advanced degrees, diversity at this level of education increases. Since its inception, about 90 per cent of the approximately 140 underrepresented and/or disadvantaged graduating students have gone on for advanced degrees.

The NJIT Ronald E. McNair Post-baccalaureate Achievement Program

The NJIT Ronald E. McNair Post-baccalaureate Achievement Program, which is funded by the Department of Education, however, has a different goal. The McNair Program seeks to recruit juniors and seniors from low income, first generation, underrepresented groups with excellent academic credentials, who are majoring in Science, Engineering and Mathematics (SEM). Its objective is that with the aid of a faculty mentoring/research experience students develop a desire to obtain a Ph.D. degree and enter the field of higher education. The students are encouraged to present the results of their research at technical conferences and to publish in peer reviewed journals. Hence, this effort would broaden the diversity in the field and provide positive role models for groups underrepresented in the professorate. Since its inception in September 1999, fifty-eight (58) students have enrolled in the program, thirty-two (32) students have graduated and Twenty (20) have enrolled in Graduate School. Of these, twenty (20) students thirteen (13) enrolled in MS programs and four (4) have obtained the MS Degree. Seven (7) have enrolled in the Ph. D. Programs and twelve (12) have been employed by industry.

The authors have served as advisor/mentors to many undergraduates in the regular curriculum research courses and for URE students and McNair Fellows. Several of these students have received Program, Institute, and National Awards for their research effort.

In addition to the above programs, NJIT has been heavily involved in two other programs:

- Educational Opportunity Program (EOP)
- Alliance For Minority Participation (AMP)

These latter two programs involve students from underrepresented groups at NJIT and are aimed at encouraging students to develop to the full extent of their abilities and continue their education.

Conclusions

It is through the above noted categories that NJIT and its Center for Pre-college Programs serves the current and future generations of students, teachers and parents. To achieve our goals, we have pledged to continue:

- providing enrichment studies in science, mathematics and technology not normally available to students in elementary and secondary schools and encouraging students to pursue careers in science, technology, engineering or mathematics, as a meaningful and realistic goal;
- providing reinforcement of basic skills in language arts, and scientific and mathematical studies to ensure proper preparation of students for entry into and completion of post-secondary studies;

- providing professional development programs for practicing teachers and counselors through modification of current curricula and/or development of new curricula to strengthen the quality of elementary and secondary schools teaching and counseling methodology;
- developing resource materials, classroom lessons and practices, laboratory experiments and demonstrations for use in the schools and disseminating the information to teachers and students for the advancement of knowledge and providing workshops to parents and families to increase their participation in and awareness of the educational process of their children in order to support them through the k-12 system in order to achieve their full potential.

The Center has undergone several fundamental transformations of its identity and objectives since its establishment in 1978. Following the adoption by the N. J. Board of Education of the Core Content Curriculum Standards in seven subject areas, including mathematics and science, school districts across the state have initiated educational reforms focusing on the implementation of standards based instruction. As a result, we have evolved from a locally focused program working with a few high school students from Newark schools into a comprehensive center functioning as an academic service department at NJIT serving over 4,500 students, teachers, parents and other professionals annually.

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