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## Summary

### Loyola / Aspira Summer Science Camp

Loyola University Chicago in conjunction with Aspira of Illinois, will offer a bilingual (English/Spanish) six week, commuter Summer Science Camp integrating computer science, engineering, and physics for twenty-seven Hispanic students entering grades seven through nine. The program continues the six week summer session with a thirteen-week academic year followup.

The interdisciplinary activities begin with students being introduced to basic computer architecture, after which they assemble IBM-compatible microcomputers for subsequently use in the program. Each week, the students are guided through experiments in three distinct labs: Digital electronics, Engineering design and control, and Computer science programming, where computer concepts are introduced through programming in the Pascal language. The summer session includes career-oriented field trips to the facilities of Argonne National Laboratories, Northwestern University, Chicago Research & Trade (a securities trading firm), and People's Gas. Students are paid a \$120 stipend to cover their transportation expenses and are granted a high school course credit through the gifted program of the Chicago Public Schools.

**Loyola/Aspira SSC** duplicates the DOE Loyola/Aspira Pre-Freshman Enrichment Project (PREP), which in turn is a bilingual version of a NSF Young Scholars Project run for younger students. The NSF Young Scholars Project has already significantly affected minority representation in computer science studies in Illinois. These programs are part of the Access 2000 network, an NSF Comprehensive Regional Center for Minorities.

**Loyola/Aspira SSC's overall mission is to intellectually nurture Hispanic students of limited opportunity, providing them with interest-stimulating experiences which enable and motivate them to take college-preparatory courses in science, engineering, and mathematics, ultimately promoting their entry into sophisticated R&D careers in science, engineering, and mathematics.**

## INTRODUCTION

The Program Announcement for the NSF Summer Science Camps expresses the need to stimulate interest in science, engineering or mathematics careers and education, expressedly for under-represented minority students. This proposal addresses the need by outlining an exceptional opportunity for twenty-seven (27) Hispanic young women and men to work closely with research and development professionals in computer science and its related disciplines, in a bilingual program that develops their talent and stimulates them to pursue education and subsequent careers in science, engineering, and math.

### Overview

*This Project will replicate a DOE Pre-Freshman Enrichment Project*

**Loyola/Aspira SSC** will replicate the DOE Loyola/Aspira Pre-Freshman Enrichment Project (PREP), which in turn is a bilingual version of a NSF Young Scholars Project (YSP) run for younger students. For overview purposes here, the proposed Program will feature an unusual, bilingual six-week summer commuter program introducing Hispanic youngsters to computer science. A thirteen week academic year follow-up is an important ingredient in accomplishing our overall intention *to provide a sustained and measurably beneficial impact* on the participants' interest and persistence in pursuing science-based education and careers.

### Interdisciplinary Approach

The senior staff brings an interdisciplinary approach to introducing computer science to students from both hardware and software perspectives. Students will experiment in three distinct forums. First, they will assemble IBM-compatible microcomputers and then perform digital circuitry experiments on the computers and other electronics equipment. Second, they will experiment with computer concepts through programs they write in the Project's software science introduction. Third, they will experiment with small computer-controlled machines, building them from the component level on up and writing the controlling programs themselves. Additionally, during the summer participants will interact with role-models and explore possible SEM careers in several arenas. A trip to Argonne National Laboratory will give students a taste of scientific research environments, and visiting Northwestern University will give them a picture of minority opportunities in science, engineering, and math (SEM) higher education. A trip to People's Gas will help students visualize engineering career paths, while a trip to a stock-market trading firm will give them an image of advanced computer science applied to the business world.

### Six Project Objectives

The Program Announcement characterizes the target population for the funding as "under-represented minority students" entering 7<sup>th</sup> through 9<sup>th</sup> grades. That target population is narrowed in this proposal to Hispanic students in Chicago who can be characterized as "high potential - low opportunity." The primary objectives are that students' *interest* in science, engineering and mathematics will be piqued as they participate in the program by:

1. *interacting* with interesting and interested professionals in various fields of computer science, mathematics, engineering and physics at a variety of facilities in the Chicago area;
2. *assembling* an IBM-compatible microcomputer and monitor from components, in a laboratory;
3. *acquiring* an appreciation of the profoundly interdisciplinary nature of computer science and its every-day life applications, and gaining a comprehensive introduction to the physics and mathematics in hardware and software;
4. *experiencing* engineering problems and solutions using their own computer-controlled devices;
5. *envisioning* educational and career opportunities in computer science; and:
6. *acquiring* computer science skills at a level enabling them to receive special high school credit.

**Mission**

*This Project's overall mission is to intellectually nurture Hispanic students of limited opportunity, providing them with experiences which enable and motivate them to take college-preparatory courses in science, engineering, and mathematics, ultimately facilitating their entry into sophisticated R&D SEM careers.*

**Rationale**

**Loyola/Aspira SSC** does not attempt to duplicate any typical course in any elementary or secondary curriculum. It is, frankly, an enrichment experience that so cuts across disciplinary boundaries and so involves academic, business, and community structures that it is not realistic to expect schools to offer the same type of opportunity. While the activities are non-traditional, we do collaborate very closely with the city schools and have embraced some traditional measures of program rationale and program success. Central among those measures is the College Board's Advanced Placement (AP) program. Only eleven (11) Hispanic students in the entire state took the AP Computer Science Exam in Computer Science (Level AB), and five of those eleven students were participants in the Young Scholars Project on which **Loyola/Aspira SSC** is indirectly based. The disparity extends beyond severe under-representation to under-preparation -- Hispanic students taking the AP Examinations in Computer Science scored, on average, more than one full point (out of five) lower than their non-Hispanic counterparts. None of the city's predominantly Hispanic high schools are among the few in Chicago which even offer AP Computer Science.

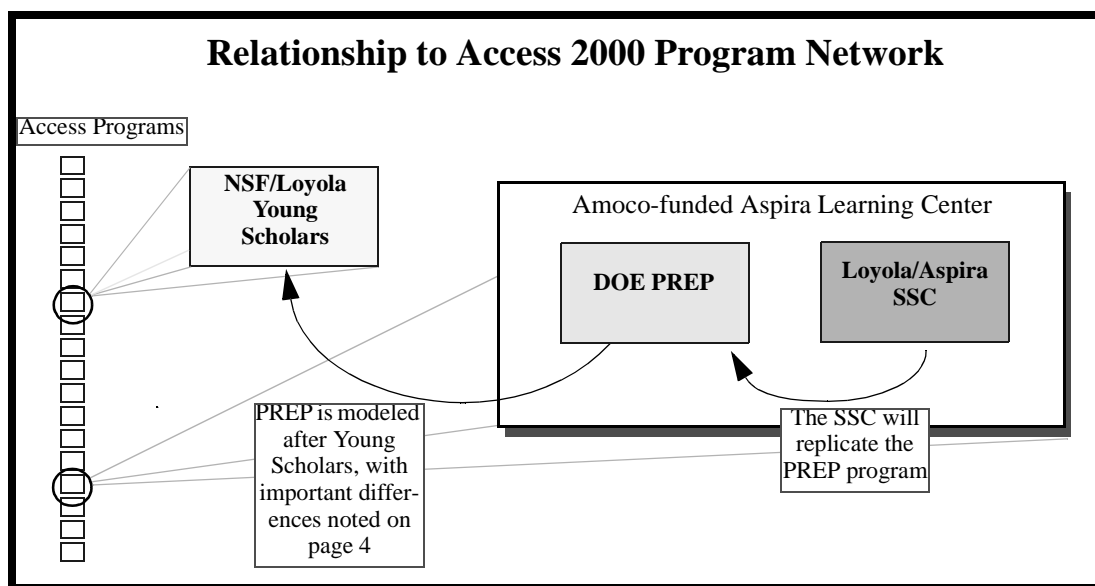
Our proposed curriculum only constitutes about two-thirds of the Level A AP material, and that material only constitutes half of our proposed curriculum. The material on the AP test, however, does provide the single greatest intersection of any standardized measure with our curriculum. These AP statistics are thus an important measure of the need for a program such as this one.

It is important to add to a rationale statement some brief comments about the Chicago Public Schools, which are particularly beleaguered by the systemic urban educational problems which must be confronted before under-representation is corrected. For the record: for each of the past two years, more than half (and all of the predominantly Hispanic) high schools in the city system had average ACT scores in the bottom 1% of the nation. Much of the Chicago educational community, including the staff of this project, is idealistic enough to believe the schools are on the threshold of remarkable change if a series of recent dramatic and coordinated initiatives work. Some of these initiatives are discussed elsewhere in the narrative, and include the School Reform Act, the Academy for Mathematics and Science Teachers of Chicago, and the Access 2000 Chicago partnership into which **Loyola/Aspira SSC** will be integrated.

**Loyola/Aspira SSC** will fit into a larger Amoco-funded initiative which itself is part of a much larger NSF-funded Regional Center for Minorities called Access 2000. **Loyola/Aspira SSC** will become an “anchor” program offering in one of the two Aspira Mathematics and Science Learning Centers funded in Chicago under a \$60,000 grant from the Amoco Foundation. The Aspira Mathematics and Science Learning Centers form one of eighteen programs in the Access 2000 network. Access 2000 is beginning its third year of a six-year, \$3.8M commitment from NSF to address minority under-representation.

**RELATED PROJECTS AND COMMITMENTS FROM NON-FEDERAL SOURCES**

**Loyola/Aspira SSC, the Amoco-funded initiative, and the NSF-funded Regional Center for Minorities**



The first page of the narrative notes that **Loyola/Aspira SSC** replicates the DOE Loyola/Aspira Pre-Freshman Enrichment Program (PREP). Currently in its second year, PREP is a fully bilingual summer and academic year follow-up commuter program for Chicago Hispanic middle-school students, giving them experiences in computer science and its related disciplines. We propose to double the motivational and

**Loyola/Aspira PREP**

educational impact of PREP by duplicating it in **Loyola/Aspira SSC**. The curriculum is more specifically outlined on page 7. PREP has been the subject of newspaper articles and was featured at length on a Chicago T.V. news program. A Loyola/Aspira PREP publicity video was created at the request of DOE during this last year and was shown in a Chicago public schools area-wide principals meeting. NSF has requested the master print of this video to incorporate segments as footage into *their* educational programs video.\* PREP participants are (and will be) tracked by the Access 2000 consortium through their high school and college years.

### **The NSF/Loyola University Young Scholars Project**

Loyola/Aspira PREP, in turn, partly replicates a NSF Young Scholars Project at Loyola University. Funded since 1988, the NSF/Loyola University Young Scholars Project offers high school sophomores and juniors a six-week summer program in math-based computer science with an academic year follow-up and is the curriculum template for this project. As alluded to earlier, half of the 1989 African-American and Hispanic students in the state of Illinois who took the AP Examination in Computer Science were Young Scholars participants. The project has been the subject of approximately fifteen newspaper articles and was featured in a WLS-TV (ABC) documentary on minority education, and its participants have been honored in a special ceremony with the Mayor of Chicago and the Chicago City Council. The project has thus garnered significant recognition. More importantly, as noted, participants indicate markedly increased intentions in pursuing science and engineering careers as a result of the project.

### ***Differences Between SSC & PREP, and Young Scholars Activities***

**Loyola/Aspira SSC**, as a clone of PREP, will offer students the same opportunities as the Young Scholars Project. The outline beginning on page 10 delineates the actual activities we will implement, but a few notes of contrast may be useful. **Loyola/Aspira SSC** and PREP differ from the Young Scholars blueprint in four ways. First, the students are two to three years younger: the curriculum is consequently slightly less sophisticated and is presented over a three-month rather than eight-month follow-up. Second, most of the activities take place in one of the Amoco-funded Aspira Learning Centers in the Hispanic community, rather than on a university campus. Third, the activities are bilingual. Fourth, the computers the students assemble are used in other Access 2000 projects and in other Aspira Learning Center activities, so the students are not be able to take them home to keep for themselves.

### **Access 2000**

In FY89, NSF awarded a \$100K developmental grant to help stimulate the development of a comprehensive regional center to promote minority access to science and technology careers. This, center, of course, is Access 2000, which was introduced on

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\* The request came from Walcott & Associates, under contract by NSF's EHR Directorate to produce the video.

page 3 and is described in more detail in Appendix F. NSF began to fund Access 2000 comprehensively with an FY90 grant of \$800K to support activities which it expects to continue supporting through FY94 with \$2.9 million in additional funds (bringing NSF's total to \$3.8 million over six years). Access 2000 is based at Loyola University and supports an array of eighteen programs involving five universities, the Chicago Urban League, Aspira of Illinois, and Argonne National Laboratory. Even in its planning stages, Access 2000 was quick to secure an unusual level of support from local and national leaders in both education and business and industry, as well as from local, state, and federal elected and appointed officials.

## **Non-Federal Support**

Other institutions or agencies which share Access 2000's mission to increase minority representation have found Access 2000's consortium approach to provide an appealing mechanism providing synergy for smaller programs. In fact, a number of corporations and state funding programs are involved in Access 2000's rather complex network of activities. The most salient of these involves the Amoco Foundation, which, during the Access 2000 developmental phase, made a contingency grant to the consortium by agreeing to fund two learning centers in the Hispanic community pending NSF's comprehensive funding of Access 2000. These two "Aspira Math and Science Learning Centers" are administered by the highly regarded organization Aspira of Illinois, and they are patterned after Access 2000 activities in the Black Churches Project, administered by the Chicago Urban League.

## ***Description of the Aspira Math and Science Learning Centers***

**Loyola/Aspira SSC** will be housed along with PREP in one of the two Amoco-funded Learning Centers. The Learning Centers themselves house a core set of activities calculated to promote the interest and skills of Hispanic youngsters in science and mathematics:

- 1. After-school and weekend tutoring activities;**
- 2. "Science nights" involving visits from retired Argonne scientists who will present the "New Explorers" videotapes to attending families;**
- 3. "Family Math" and "Family Science" activities, originally developed at UC/Berkeley;**
- 4. Science experiment sessions using materials developed in a major curriculum project at the University of Illinois (Chicago) called TIMS -- Teaching Integrated Mathematics and Science.**
- 5. Systematic use of a comprehensive city-wide directory of accessible math and science programs to encourage students and their families to persist in science and engineering career hopes.**

Among the fifteen projects supported by Access 2000 is still another version of the Young Scholars Project, designed for teachers. The aim of this activity is to

present, at a more sophisticated level, a math-based introduction to computer science which will prepare teachers of minority students to implement computer science curricula in their own schools. Related to this program is the funding through Access 2000 for three (3) teachers to be involved in the PREP (and potentially SSC) program. These teachers will be involved along with students *as participants*, experiencing first-hand the SEM interactive learning environment, which we hope will give them the impetus to replicate the same types of learning activities in their own classrooms.

### ***Funding by Kraft***

Kraft has given tentative advanced approval for infusing PREP with \$6,000 to enhance the program.\* In particular, this will allow for two additional students, two additional computers for the lab, expansion of the Lego/Pascal labs, and the development of middle-school level Spanish computer science curriculum, which would directly benefit SSC.

### **PROGRAM DESIGN**

**Loyola/Aspira SSC** will consist of a six-week summer commuter program followed by a thirteen-week Wednesday afternoon program during the following fall semester. In order to create a mutually encouraging and safe group atmosphere in which the students can experiment and learn, we will take the students through a “ropes course” on the first day. This activity will induce students to interact with each other extensively, building a strong sense of group identity.

### **Review of Project Activities**

The six-week summer phase components are outlined in a calendar appearing in Appendix B. The components consist of the following::

### ***Summer Phase Components***

- **Computer Science Lecture/Discussion:** Following an introduction to using the keyboard, students are introduced to fundamental computer concepts through the presentation of progressively sophisticated material in the Pascal programming language. Presented material is reinforced through corresponding Laboratory assignments. (18% of summer phase)
- **Computer Science Laboratory:** In the Computer Lab at the Learning Center, students will design, write, and run the programs assigned in the Lecture/Discussion component. (19% of summer phase)
- **Hardware Design/Circuitry Lecture:** This will be a simplification of the material presented in the Young Scholars Program and in Loyola University’s Physics department, and is oriented around preparing students for the labs below. (7% of summer phase)
- **Hardware Design/Circuitry Lab:** This is a hands-on digital circuitry lab based on the material presented in the hardware design/

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\* This is considered a firm offer. We will notify NSF’s program office if it does not materialize as expected.

circuitry lectures. It includes students building the P.C.'s which they will use in the remainder of the program. (7% of summer phase)

- **Lego/Pascal:** In this lab students are introduced to the design of small machines using sophisticated Lego sets. Engineering and control problems are then explored as students write Pascal programs to control the machines they have built. (30% of summer phase)
- **Field Trips:** 5 hours/week. As indicated earlier, we will take four field trips: to Argonne, a stock market trading firm (CRT), People's Gas, and research facilities at Northwestern University. (19% of summer phase)

***Academic Year  
Phase***

The academic year phase will be a continuation of the computer science components from the summer phase, administered in cooperation with the Gifted Program Office of the Chicago Public Schools with credit issued by the Chicago Board of Education.

***Disciplinary  
Focused Activities***

The Computer Science concepts are presented using the Pascal programming language. Pascal is used in the Advanced Placement program and is widely recognized as an excellent teaching language. During lecture/discussion, material is presented, discussed, and then illustrated by having students in groups of two or three finish partially completed programs, working at the computers. These partially completed programs are carefully structured to lead students into implementing examples of the material discussed. Later in the lab component, students work more independently at the computers, writing programs which involve graphics and sound, again reinforcing the concepts they have learned. The sequence of topics actually covered is the most orthodox part of the project, and, during the summer component includes:

***Computer Science  
Content***

an introduction to the basics of programming; simple algorithm construction, computer programs as a means to solve problems; the simple objects, relations, and operations of a computer program; scalar data types, arithmetic, logical and relational operators; simple predefined functions and procedures and changing the flow of control; looping structures; introduction to modularity.

During the academic year computer science component, students will reinforce the concepts learned in the summer and go on to study:

parameterized procedures and functions; structured data types including arrays, and user-defined data types.

***Lego / Pascal***

The Lego/Pascal component was the students' favorite activity last year in PREP. It started as Lego/Logo, an educational package developed by Seymour Papert at M.I.T. and has been modified by Renee Rivera (program staff) to use the Pascal programming language rather than Logo. This modification allows students to concen-

trate on and reinforce only one programming language during the program. Students begin with the design of small electro-mechanical machines using Lego gears, wheels, motors, infra-red sensors, and touch sensors. Last year in PREP students built:

- A car which followed a line on a table using an optical sensor;
- A miniature assembly-line conveyor belt which automatically sorted Lego pieces into long and short;
- A robot arm which was programmed to move a set of pieces from one point to another;
- A washing machine model with sensors to rotate the washing drum only when the door is shut; and
- A ferris wheel model which stops at the appropriate spots, ostensibly to let passengers on and off. (See the photograph of this in the Appendix)

After building the devices, students write the programs to provide software control. As mentioned earlier, students encounter engineering and control problems as they learn to refine their designs to take into account the physical parameters of motor speed, gear ratios, leverage, loads, and piece strength. The Lego/Pascal component is one of the most powerful learning activities for the students because they have concrete motivation to master the Pascal programming structures necessary to do tasks which they can actually see. Students essentially get to feel, touch, and interact with the results of the programs they write!

### ***Hardware Design and Circuitry***

The scope of the hardware design and circuitry lecture/lab components is rarely if ever found in pre-collegiate programming.\* The material presented is extracted from Digital Electronics courses taught at Loyola and Northwestern Universities. The approach involves discussions and hands-on experience with gate level circuits through general block diagrams of computer architecture. Students are initially exposed to computer circuits in the first week of class when they assemble the Intel-based (MS-DOS) computer systems consisting of: 20 chips (including memory), three interface cards, power supply, case, floppy drive components, keyboard and monitor. Subsequently the following topics are discussed:

a basic electronics introduction; breadboarding techniques; combinatorial logic devices including logic gates, Boolean algebra and Karnaugh maps; implementation of combinatorial logic devices

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\* During last year's PREP field trip to Northwestern University's school of engineering, students noticed that class lecture notes left up on the blackboard in a classroom corresponded exactly to digital logic material they had learned in the program!

such as adders and multiplexers.

The key to this approach is the integration of the lecture material with the hands-on experience in the laboratory, giving students a basic working knowledge of computer hardware components by the end of the summer. Students will be required to keep careful records of their lab experiences in a lab notebook, which will be graded as described below.

### ***Organizational Skills***

Experience with the PREP program has pointed out the need to teach students organizational and note-taking skills. We will interact on a regular basis with students in this area by grading their notebooks once a week. These notebooks will contain homework assignments, a record of lab experiences, lecture notes, and handouts.

### ***“Student Investigations” As A Pedagogical Approach***

The program announcement emphasized enabling students “to experience the excitement of *doing science*.” This program provides an environment requiring extensive hands-on experience: students spend over half (56%) of their time in either a computer laboratory developing computer programs, a digital electronics lab building and electronically experimenting with relatively sophisticated microcomputer systems, or a Lego/Pascal lab developing their own computer-controlled devices. Students are consistently led to view learning as a pursuit of discovery rather than as a pursuit of information. The particular discovery approach used in the program was developed by Eric Hamilton (Director of Access 2000) over six years with academically talented junior and senior high school students at the Center for Talent Development at Northwestern University, and for the past three years in the Young Scholars Project. Students are led to discover concepts in computer science, digital electronics, and engineering in a highly interactive environment.

### ***Career Exploration Activities***

An outstanding lineup of computer science, engineering and mathematics practitioners has agreed to host facility visits and tours for Program participants. In most cases, our hosts are Hispanic and can specifically address the socio-economic situation of our Project participants. The sites are as follows:

### ***Career Seminars***

- 1. Argonne National Laboratory** - a scientific research environment; displays and models of on-going research projects; demonstrations of both superconductivity and high-resolution computer graphics; supercomputers;
- 2. Chicago Research and Trade (CRT)**- the opening of the grains trading floor at the Chicago Mercantile Exchange (narrated in Spanish); a tour of the technical trading office of CRT; examples of how computer technology is used in a business environment;
- 3. People’s Gas** - A tour of a central work facility including a welding shop and a computerized dispatch center; a trip to a remote active job site (hard-hats and vests required for all!), showing how gas lines feed into everyone’s homes;

- 4. Northwestern University** - a university environment; a tour of the facilities; graphical software demonstrations in various computer labs; a presentation on engineering scholarship opportunities for Hispanic students.

Besides the above four, the first day of the program we will take a “group building” field trip to a ropes course, as mentioned earlier. In each of the above sites we will have a private meeting with our host, who will reflect on both his/her personal career choices and how those choices were pursued, as well as his/her anticipation of technical and societal trends due to advances in computer science and engineering. Students will be asked to reflect on and to articulate their own career expectations and hopes, as unevenly or vaguely formed as they might be. The students can expect direct responses and comments by their hosts to their reflections. Such responses may come in many forms, including simple encouragement, as well as informed suggestions or advice. The field trip hosts have uniformly found the visits as rewarding for them as we believe they have been for the students.

### ***High School Curriculum Advising***

Additionally, we will have a visit from a high school counselor to advise students what courses to take which years in high school. Many capable students in Chicago miss the SEM “fast-track” by being shunted off from Algebra courses in junior-high school. Our hope is to give our students concrete goals in terms of courses in which they may be interested as they start high school.

There is no requirement that students will “buy into” a SEM career based on their experiences in the program, but students will be given the opportunity to listen and interact with professionals in terms of how those professionals chose and followed different career paths, and how they now reflect on those paths. The participants will see a number of available options leading to several different types of stimulating and productive careers.

### ***Schedule of Activities***

#### ***Summer Phase Course Schedule***

The six-week summer phase will involve 22 classroom meetings, with each week involving 16 hours of academic on-task activity, field trips for 5 hours, totalling 23 hours of formal activities together. The classes will take place Mondays through Thursdays and will follow the schedule below. Field trips will be held on the first day of class and on Fridays in subsequent weeks, as indicated on the schedule. Each class day involves four hours of on-task activity between 8:00 a.m. and 12:15 p.m., with a fifteen minute snack break dividing each day into 2 two-hour sessions (8:00 to 10:00, and 10:15 to 12:15). The 27 students will be divided into three groups of 9 each, allowing for the more personalized attention of a 1:8 student-teacher ratio over-all. Each of the three groups will rotate through the following activities, two activities a day:

1. **Presentation / guided discovery (Pascal & Digital Electronics)**
2. **Hands-on application of laboratory assignments (Pascal & digital Electronics)**
3. **Lego / Pascal: designing and constructing small computer-controlled machines.**

The detailed daily schedule (Appendix B) specifies 3 groups (A, B, & C). For example, over a five-day period group A would have:

- Day 1: Pascal Lecture/Discussion, Pascal Lab
- Day 2: Pascal Lecture/Discussion, Pascal Lab
- Day 3: Digital Electronics Lecture/Discussion, Digital Electronics Lab
- Day 4: Lego/Pascal for both sessions
- Day 5: Lego/Pascal, Pascal Lecture/Discussion

On the last morning of the Program students will prepare presentations of the work they have done over the course of the summer, which they will then present that night at an Open House to parents, community members, and the media. This was one of the highlights of last year's PREP program, seeing students lucidly presenting their work, showing *ownership* of the concepts they had studied.

#### ***Academic Year Phase***

Thirteen 2.5 hour classes after school on Wednesday afternoons during the fall semester of the academic year will be held at the Learning Center. During these classes, students will continue the Pascal programming component, as outlined in the extended discussion on the Pascal lecture topics in the Summer Phase. Students will be awarded credit by the Board of Education which, at each student's option, may be applied as an elective towards graduation. The course credit option is an incentive for students, and should not be viewed as an indication that the proposed activities replicate other opportunities these youngsters might have, because they don't.

#### **Unorthodox Program Features**

*A notable feature of this program is that it is bilingual, with instruction, hand-outs, tutoring, and field-trips being communicated in both Spanish and English.* All of the students speak Spanish as their native language, with varying degrees of English proficiency. Having a bilingual program staff allows us to provide an exceptional educational opportunity to high-potential students who would not be able to participate in any other special programs because of the language barrier. We encourage our students to make the transition into communicating effectively in English as they head towards high school.

This year three middle-school teachers will be involved in the program *as participants* through funding from the Access 2000 consortium. This is part of a long-range plan to equip area teachers to reproduce SSC activities on their own.

A guiding Project philosophy is that the experience it offers will not only assist participants in the career choice process, but that it would also equip them in practical ways to more successfully pursue the educational choices that will provide the foundation for their careers. For this reason we award a high school computer science course-credit through the Board of Education. We also pay students a \$120 stipend which helps defray their transportation costs in getting to-and-from the Project site, as well as defraying possible summer employment income. The stipend and the issuing of course credit will remain subject to carefully defined contingencies: absences and tardiness during the summer affect the amount of the final stipend, and absences during the school year affect the course grade assigned for high school credit. Parents and students consider these terms to be reasonable and agree to them in writing before the program begins.

## **TARGET POPULATION**

The target population for this program is “high potential / low opportunity” Hispanic young men and women who are entering grades seven through nine, particularly those who might not yet be accepted in other programs because of an English language barrier. The minimum expected standard will involve students falling in the top half of their classes, although others will also be considered with appropriate teacher recommendations. Most applicants will come from the Humboldt Park area of Chicago, a predominantly Hispanic section of the city with a 58% high school drop-out rate.\*

## **PARTICIPANT RECRUITMENT, IDENTIFICATION & SELECTION**

### **Recruitment**

Recruitment will occur through a combination of personal classroom visits, mailings to area schools, Chicago Public Schools Bulletins, and the Loyola/Aspira PREP publicity video. Access 2000 now publishes a directory of all area science programs, and distributes that directory (with applications) to each school and local school council in the city. Project announcements and invitations for applications will be sent directly to the Principals, Bilingual Program Directors, and Math and Science teachers in the twenty-three Humboldt Park area schools. Recently the publicity video for Loyola/Aspira PREP was shown at a Chicago Public Schools area-wide principals’ meeting and there was a tremendous response by the principals, who would like as many of their students as possible to participate. Project announcements will also be included in the periodic bulletins of the Chicago Public Schools. Recruitment also occurs through Aspira of Illinois and the Deanery 5 Youth program, both trusted community organizations with extensive personal contacts in the Hispanic community, particularly for those students in parochial schools.

### **Identification & Selection**

The ideal applicant is a native Spanish speaker, entering seventh through ninth grades, who is in the academic top half of his/her class, exhibiting an aptitude or an

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\* Network for Youth Services (NYS), 1991 report funded by the MacArthur Foundation and the Allstate Foundation. (312) 227-0416

interest in science and math, and who is highly recommended by his/her teacher, school counselor, or special program director. Bilingual student applications (Appendix C) are used to help discern the students' abilities, aptitudes, and background through a combination of essay questions and check-off lists. Because grades are often not a reliable barometer of ability for minority middle-school students, we depend heavily on teacher recommendations (Appendix D). These recommendations provide us with a picture of the applicant's language abilities, maturity level, and intellectual ability.

The channels for distributing Project announcements and applications are already in place, as they are being used for Loyola/Aspira PREP. Applications are due April 30, with students being notified of acceptance in the beginning of June. It is our hope that twice the number of students will benefit this year through the funding of this proposal. Last year (the first year for Loyola/Aspira PREP) we had 100 applicants for the 26 spots. The total number of applicants should increase to somewhere between 150 and 200 applicants this year due to favorable publicity in the Spanish-speaking newspaper *La Raza*, a television news report on the Project on Channel 32, as well as increased excitement and support from the area schools' principals generated by the PREP video. All of the applicant review and selection will be conducted by the PI, ensuring that the group will be balanced by gender, with particular attention to women.

## **PROJECT STAFF**

The PD, Dale Reed, is well qualified to direct this effort. Mr. Reed is completing his doctorate in computer science at Northwestern University, concentrating in artificial intelligence. He is currently co-PI along with Eric Hamilton of the program which we propose to replicate, Loyola/Aspira PREP. He has participated for two years in the Young Scholars Project as a course instructor who has attracted intense loyalty from students of all backgrounds. He is a highly visible leader in one of the Chicago area's largest churches, and is a highly regarded computer consultant. His background includes running a wholesale business in Mexico City, and he speaks Spanish with native fluency. Reed's immersion in Hispanic language and culture and his sophisticated background in computer science bring to this project singular leadership resources which are just beginning to benefit the Chicago educational community.

Ms. Aida Sanchez-Romano is executive director of Aspira, Inc. of Illinois. In this capacity she has directed a variety of efforts to ensure that the disadvantaged Hispanic youth have equal access to quality education. She has implemented an alternative high-school, as well as a variety of tutoring programs. She was responsible for identifying and negotiating the project site discussed below, and is a principal liaison with the Hispanic community in the Humboldt Park area.

Eric Hamilton designed the Young Scholars Project that served indirectly as a

model for this proposal. Dr. Hamilton is the Young Scholars PD, and will act in an advisory capacity to this project. Hamilton is also the PD for the Access 2000 CRCM network, and conceptualized and proposed the Aspira Math and Science Learning Centers, one of which will house Loyola/Aspira PREP. Hamilton has developed the mathematics-oriented computer science curriculum in specialized programs he has designed and has administered since 1984 to several hundred seventh through twelfth grade students in programs at Northwestern University and at Loyola University.

## **PROJECT SITE AND PARTNERS**

This narrative has repeatedly referred to two important efforts which highlight not only Loyola University's capacity but also its leadership in hosting pre-college enrichment programs. These, of course, are the Access 2000 CRCM Project and the Young Scholars Project. The university's facilities and leadership in addressing minority under-representation have been carefully scrutinized not only by NSF, DOE, and Amoco, but also by the regional partners (such as Argonne, Northwestern University, and the Chicago Urban League) in the Access 2000 CRCM network that Loyola manages. Loyola's partner in this proposal, Aspira of Illinois, is also well-equipped for this effort. It is the best known education-oriented community organization in the Hispanic community, and is a chapter in the national Aspira organization. Aspira's activities and capacity for administering educational programs have been scrutinized extensively by its individual and corporate benefactors, and most recently by the Amoco Foundation in funding the Aspira Math and Science Learning Centers as a part of the Access 2000 network.

The Learning Center where this project will be located is at 1405 N. Washtenaw, in the heart of the Humboldt Park area of Chicago, at a facility which is shared by the Chicago Public Schools. Four classrooms will be used to house the various lecture and lab sessions, with equipment for the digital electronics lab loaned by Loyola University. The present computer lab currently has 18 IBM-compatible P.C.'s, and will increase to 38 with funds from this grant and other sources. The Learning Center is easily accessible by public transportation.

## **ANTICIPATED RESULTS**

The Center for Talent Development at Northwestern University will work with Dr. Hamilton conducting the evaluation and tracking component of the Project, as part of their responsibilities in the Access 2000 consortium. The Project also implements a number of very conventional evaluation techniques. Student notebooks will be graded weekly, and a final exam will be given. Additionally, students have to complete their computer programs in a working fashion. All of these assessments are incorporated into grades that we have arranged to become part of the student's official high school record, as an added reward for participation.. Pre-and-Post testing will be used to evaluate participants' changes in attitude over the course of the project.

We expect that over 95% of the participants will indicate significant and sustained

increases in interest in science and mathematics as a result of **Loyola/Aspira SSC**, using an interest-measure designed under NSF contract by the COSMOS Corporation in Washington. 100% of the current Young Scholars students have reported such increases in interest in science and mathematics.

Since we do not intend for our students to cover the entire AP curriculum, and indeed about half of our curriculum is not related to the Advanced Placement (AP) Exam at all, most youngsters completing **Loyola/Aspira SSC** will require further study (in grades 10-12) to prepare for the AP exams. We intend for them to do that. If necessary, we will provide further preparation for them through any of several mechanisms in the Access 2000 network. By 1994, we expect the cadre of 1992 **Loyola/Aspira SSC** participants to at least double the current statewide participation in the Computer Science Examination Program, at both Level AB and Level A. This implies at least 11 out of the 27 will take Level AB, and another 11 will take at least Level A. (Over 90% of the students in the Young Scholars Project take either or both of the AP Exams in Computer Science, and meet or exceed the performance of their peers city-wide.) We expect these students will achieve higher average scores than their counterparts statewide, Hispanic or non-Hispanic. These are ambitious but tangible goals.

These goals are also attainable. The Learning Center in which **Loyola/Aspira SSC** will take place will remain available, with computers, for students to continue their studies. Equally important, the Learning Centers, as part of the larger Access 2000 network, will include staff which will be working with students for several years after their initial contact -- these twenty-seven students will be *followed*. This is one of the two principal advantages to funding this activity in the context of a comprehensive regional center for minorities -- we will systematically "stay with" or "track" these students. (The other principal advantage is the enhanced resources at the Learning Centers and elsewhere in the Access 2000 network which become available to students as they enter any Access 2000 program.) These students will be encouraged to continue in other science-based enrichment programs. They will know and come to share the expectation that before they graduate they will take the AP Examination. They will have the opportunity to take AP courses -- if not at their schools, then, as mentioned, through other Access 2000 activities.

Enhanced interest/persistence and increased AP Exam participation and achievement are the two areas of anticipated results which local staff and which NSF can most readily measure. They are also consequences of achieving the six objectives appearing on page 1. Though achieving those objectives is less measurable, they are nonetheless powerful outcomes. Loyola/Aspira PREP students will take ownership of the sense that science-based careers are natural and accessible life paths which they can pursue.