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Strategies of education and training for disadvantaged groups

Attacking urban poverty: how universities can help

Project TELL (New York City) Telecommunications
for learning

Helen Birenbaum and William Kornblum

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Telecommunications for learning

Helen Birenbaum and William Kornblum



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LIST OF ABBREVIATIONS

BOE	Board of Education
CCNY	City College of the City University of New York
CUNY	City University of New York
DOS	Disk Operating System
First Class	The Board of Education's upgraded telecommunications network
JHS	Junior high school
NYC	New York City
NYCENET	The Board of Education's telecommunications network for New York City public schools
NYNEX	Previous name of the Bell Atlantic Corporation
PC	Personal Computer
PS	Public school (elementary)
SAT	Scholastic Assessment Text

PRESENTATION OF THE SERIES

The theme of the education and training of disadvantaged groups is high on the agenda in many countries, because it is related to a much wider phenomenon: growing deprivation and social exclusion. This situation is not only disturbing, it is also a paradox in that the increase of poverty and exclusion often goes hand in hand with economic growth. This worrying observation implies that an increase in wealth is not a sufficient remedy, but must be accompanied by job creation and the redistribution of revenues.

It is evident that a scarcity of jobs or employment opportunities are often at the heart of the problem of deprivation and social exclusion. However, non-access to educational and training programmes is also a critical factor. In fact, low levels of schooling, or even the total absence of schooling, often contribute to a precarious integration into the job market.

The role of education is not just limited to giving young people access to jobs and a decent living wage. The admission of disadvantaged groups to educational and training programmes is part of the wider concern of promoting the educational process throughout one's life, the indispensable condition not only for a durable integration into the job market, but also for a full and active citizenship. Moreover, in most cases, educational investment produces long-term effects, allowing one to eradicate the transmission of poverty from one generation to the next.

Educational and training programmes are still poorly adapted to the needs of disadvantaged groups, a fact which is confirmed by the high percentage of children leaving school at an early age. To respond to these needs, the public sector has had recourse to various mechanisms. Moreover, private initiatives are proliferating outside of formal education channels thanks to the involvement of NGOs, often drawing on outside aid. Despite the undeniable contribution that they have made

to disadvantaged groups, their overall achievements do not constitute a satisfactory response, given the seriousness of the problem. No solution will really be found as long as the educational system continues to produce social outcasts. That is why it is important to draw the appropriate conclusions from these evaluations, taken from both the public and private sectors, and to set up a funding process needed for a more global approach to the problem.

The research project on “Alternative educational and training strategies for disadvantaged groups”, which the Institute is continuing to develop and elaborate, has in fact as its main objective the gathering and sharing of information on educational and training projects and programmes aimed at the disadvantaged. The second objective consists of studying their content in detail. The third is to examine the existing machinery between public administrations and other key players, and to analyse the tools and methods used to evaluate these projects and programmes. The final aim is to encourage political and technical dialogue, and to bolster national capacities to create and implement programmes aimed at the disadvantaged.

The notion of disadvantaged groups is difficult to grasp in any concrete sense. It can be defined in several ways, according to various criteria (social, economic, etc.). It is also a relative concept, including different realities according to context. That is why the current project does not exhaust all aspects of this concept. It confines itself to studying unqualified young people who have not had access to schools or who have been prematurely excluded.

The project is especially interested in the role of the various players in the public sector. This preoccupation revolves around a double-pronged series of questions:

- How to open up and adapt educational and training systems so as to give access to the disadvantaged? Is this possible? What are the appropriate strategies? Under what conditions are they to be applied?

- How to delegate teaching and training responsibilities for disadvantaged groups to other players: NGOs, local initiatives, community associations, the business sector, etc.? How to promote, guide, control, co-ordinate, finance and evaluate their actions?

These two options are complementary. In fact, it can be assumed that the experience gained in initiatives launched on behalf of disadvantaged groups will have wider repercussions of benefit to overall educational policies.

Project TELL, a seven-year longitudinal study, assessed the effects of introducing telecommunications technology into the home of at-risk middle and high school students in New York City. The project was created by the Stanton/Heiskell Telecommunications Policy Center in response to the growing information gap between low-income families and communities and their more affluent counterparts. It is probably the only longitudinal study designed specifically to examine the impact of computer technology on the educational performance of disadvantaged urban youth. This book describes the project in detail, how it proceeded, and highlights some of its interesting results.

**The Stanton/Heiskell Center for Public Policy in Telecommunications
and Information Systems, the City University of New York Graduate
School and University Center**

Founded at the City University of New York Graduate School in 1988, the Stanton/Heiskell Center for Public Policy in Telecommunications and Information Systems studies the social and economic impact of telecommunications, particularly as these relate to the need for increased and equitable access among low-income and disadvantaged communities. Project TELL is a partnership between Bell Atlantic, the New York City Board of Education and the City University of New York.

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INTRODUCTION

Background

For seven years (1990-1997) the Stanton/Heiskell Center studied the educational gains disadvantaged inner-city children made when given access to computers in their homes. Project TELL is one of the first demonstrations of after-school home use of networked computers to encourage learning among disadvantaged students and their families.

The project was created in response to the growing information gap between low-income families and communities and their more affluent counterparts, who have far greater access to telecommunication technologies.

Bell Atlantic recognized this disparity and formed a partnership with the City University of New York (CUNY) Graduate School and the New York City (NYC) Board of Education (BOE) to provide technical resources and financial support. The partnership is an example of how three institutions successfully pooled the talent and resources necessary to support a major socially strategic and complex programme of research.

The goal of Project TELL was to determine if students reading at the 25-50 per cent level in Grade 5 could improve their school performance and succeed in gaining admission to college. We hypothesized that a significant proportion of underachieving students could reverse educational failure through home access to computers and telecommunication networks, supported by educational back-up systems. Our emphasis was primarily on the computer as an aid to the education process and only secondarily as a skill for employment.

The results were encouraging: 46 per cent graduated from high school in four years, as compared to the system-wide (BOE) average of

49 per cent, which includes high-achieving students. What is more significant, the system's graduation rate for minority students, 41 per cent, is 5 per cent lower than that for the participating TELL students, all of whom are minority students.

The project was initially funded for three years, commencing with middle school (Grades 6-8). We found that time spent on the task of reading and writing in a computer-based telecommunications environment could be correlated with individual gains in motivation and school performance. The results of the first three years were so positive that Bell Atlantic continued support for four more years. The challenge of the high school phase of the project, Grades 9-12, required academic tutoring both electronically (on the network) and in-person to help students raise their achievement levels to meet college admission standards.

Bell Atlantic was the primary funder of the project. The Center received supplemental grants from corporate and private foundations for specific initiatives, e.g. peer tutoring. The project cost was approximately \$300 000 per year. Bell Atlantic donated upgraded computers during the fourth year of the project. Reduced costs for telecommunications hardware and services as well as inventive leasing arrangements will significantly lower the costs of future projects that support technology access to low-income homes.

Clearly, we found no 'quick fix' solutions to the educational problems of the disadvantaged. However, our major findings acknowledged:

1. Continual personal participation by concerned adults through direct contact and over the electronic network was essential to the students' progress.
2. Home computers and Internet access, along with training in their use, and continued adult and student interactions in an on-line

learning environment can 'turn around' a significant number of underachieving inner-city students, and encourage learning and literacy among siblings and family members in the home.

3. Parental (and/or guardian) involvement can significantly influence student achievement; co-operation with the school, administrators and teachers can influence and enhance student outcomes.
4. Information technology can compete with TV and the lure of the streets, even encouraging some students to seek refuge from the streets.
5. The lack of educational software for underachieving middle and high school students is problematic. As the development of educational software accelerates, moving away from 'drill and kill', and becoming more interactive and diagnostically sophisticated, it appears to be only a matter of time before applications and programmes on the Internet will have a more qualitative educational impact.
6. The continual need to upgrade computers to keep up with the developing sophisticated software, places low-income families at a disadvantage. Affordable access to the Internet, as well as to the new software, must become more readily available.

In conclusion, we recommend that: (1) early family access to information technology should be encouraged, (2) research to address issues of technology's cost and software should continue, and (3) on-line learning opportunities should be incorporated in plans for educational reform.

Urban poverty and education

A disturbing number of American students are increasingly exhibiting the characteristics of the educationally disadvantaged (namely, they are from poor minority groups). Disadvantaged students mostly are (and will be) concentrated in cities. Defining the

educationally disadvantaged as those students who “have been exposed to inappropriate educational experiences in at least one of ... three educational domains” formal schooling, family, and community (Natriello, McDill and Pallas, 1990, p. 15) Natriello et al. assert that the proportion of children living in poverty in the United States is expected to increase from about 16 per cent in 1979, 22 per cent in 1983, to 27 per cent in 2020 (Natriello, et al., 1990, p. 16). Not surprisingly, other indicators of an educationally disadvantaged status are expected to increase (most strikingly the number of children living with mothers who have not completed high school) from 13.6 million in 1983 to 21.2 million in 2020 (Cummings and Koebel, 1992). Children’s success and mobility are influenced by parents’ educational attainment.

Education for minorities is generally inadequate, beginning in the elementary schools and continuing through the high schools. “Lack of optimal environmental stimulation in the early childhood of lower-class children produces sequelae that are manifest later in life” (Cummings and Koebel, 1992, p. 6). By the time many minority children have entered junior high school, they do not meet grade-level expectations and cannot compete successfully academically with achieving youth.

The scholastic scores of minority students start to deviate from the norm beginning in elementary school, and the deviation downward from the norm widens with each successive year. Herewith are the statistics from the *Board of Education of the City of New York 1997 – ranking of elementary and middle schools by reading achievement*: 676 elementary schools and 234 junior high schools were ranked, based on the per cent of students reading at/above their grade level, 1 being the highest-ranked school and 676 the lowest, and per cent being the per cent of students reading at/above their grade level.

Community School District 28 will illustrate the disparities evident within a single school district that is divided along class and ethnic lines.

The elementary public schools (PS) ranking the lowest in reading scores in District 28 are: PS 30 (490, 36%), PS 40 (571, 29.9%), PS 48 (530, 33.1%), PS 140 (450, 39.3%) and PS 160 (410, 42.9%), all are in low- to middle-income, predominantly black neighbourhoods, while the schools ranking the highest in District 28 are: PS 196 (3,92.0%), PS 101, (23,84.7%), PS 174 (40, 80.0%), PS 144 (58, 77.6%), and PS 139 (78, 74.6%), all are in upper-middle and upper-class, predominantly white neighbourhoods. Many of the children who graduate from the lowest-ranked elementary schools will enter the two lowest-ranked junior high schools (JHS) in the district: JHS 8 (194, 22.9%) and JHS 72 (157, 31.6%) which are in low-income Afro-American neighbourhoods.

Following is an illustration of the disparities among low-income and more affluent school districts: District 1 in a low-income area, and District 26 in a middle- and upper-income area. District 1 has 18 elementary schools with an average ranking of 474, 29.6 per cent, and 6 junior high schools with an average ranking of 161, 31.1 per cent; while District 26 has 20 elementary schools whose average ranking is 37, 94.4 per cent, and 5 junior high schools' average ranking of 17, 92.5 per cent. The educational and income levels of parents can often be directly correlated with the educational attainment and income levels of their children. Most minority and low-income families cannot afford private tutoring and enrichment programmes. However, college enrolment among low-income minority students is increasing, especially in urban public institutions. Many college-bound, low-income students are the first in their families to attain a degree and, as such, do not have prior familial experience and guidance regarding collegiate education and future opportunities. The Stanton/Heiskell Center is suggesting that this project can be a model to reinforce the advantages of a college education among disadvantaged students.

Project TELL: closing the information gap: a proposed solution

Educators and political leaders in the United States and Europe are increasingly concerned about the widening 'information gap' between affluent families who have computers and access to the Internet (at home and in schools) and poor families who have far less access to these powerful technologies of the information age (Castells, 1996; Kantrowitz, 1994). Project TELL explores the question of what gains young people from disadvantaged backgrounds actually do make when they gain access to computers and information networks for use at home during their middle- and high-school years. In addition to this most basic research question, all the participants in Project TELL have had a wide range of valuable experiences, as educators and students working together to create an on-line learning community, separate from their actual schools but inevitably linked to them as well.

Overall, the results of this research will demonstrate that through home access to computers and telecommunications networks, a significant proportion of underachieving students could make immense strides and even reverse educational failure. But as in all social research, this statement requires qualification and further analysis. In particular, it is important to emphasize over and over again that home computers and telecommunications technologies alone do not represent a magic bullet for educational reform. Their successful use, as we will show, depends unquestionably on the presence of educators and other helping adults who can teach students (and teachers) how to use the hardware and who will work with them to realize the technology's potential to support learning experiences. If these criteria are met, student participation on line can effectively lengthen the school day and offer learning resources previously not available to the students or their families.

As a longitudinal study over seven years, Project TELL is unique among the small number of demonstration research studies on the issues

of computer and network uses and school achievement (Siefert, Gerbner and Fisher, 1989; Winner, 1997). Our research is of particular relevance in the burgeoning literature about computer-assisted learning in that it traces the effects of home computers with network access on the lives of disadvantaged students and their families. We have been following a group of New York City public-school girls and boys (now young men and women), from lower-income, predominantly minority families in representative inner-city neighbourhoods. We began working with the students in 1990 when they were in Grade 6 and enrolled in five New York City middle schools, one in each borough. These schools are essentially average for the inner city, each with a high proportion of students who score below the mean on standardized reading and Mathematics tests. After middle school the students were dispersed over more than 40 different New York City high schools.

TELECOMMUNICATIONS FOR LEARNING

Objectives and planning

In broadest terms, the goals of this first phase of Project TELL were: first, to assess any gains in school performance, self-esteem, writing and typing ability, knowledge of computers, and school attendance for students who had home computers; and, second, to describe the lessons learned from participation in a telecommunications-based learning community composed of TELL students, their parents and teachers and other adult mentors from the Project TELL staff and elsewhere. The central research hypothesis of the middle-school phase of Project TELL was that time spent on tasks of reading and writing, in the purely symbolic environment of computer-based telecommunications networks would be correlated with individual gains in school performance.

The programme also aimed to enhance students' computational abilities and their ability to write clearly and with greater command of grammar and vocabulary. We captured many hundreds of pages of the students' writing for further analysis of how time on line with peers and teachers actually did shape greater literacy and verbal abilities. In the area of numeracy and Mathematics competencies, we continually sought to encourage students to overcome anxieties about computation and problem solving. We encouraged them in every way we could imagine to use the computer to reach out for help in developing their mathematical skills. In the middle-school years teachers provided on-line Mathematics exercises for their students which often became the subject of real-time chat sessions as well. In the high-school phase of the project, we developed a number of experimental approaches to on-line and in-person Mathematics tutoring. Overall, the aim of these efforts was to increase the probability that our students would succeed in passing the required statewide competency exams which are essential for their eventual graduation from high school and college admission.

In addition to efforts to raise school performance levels, we also developed goals in the areas of self-esteem and attitudes towards schooling. Students' writing on line often dealt explicitly with self-esteem issues, and we measured changes on self-esteem scores each year during the middle-school phase of the programme. In the high-school phase, we developed a number of approaches to building more positive self images among the students, including an intensive weekend retreat devoted to this issue, as well as regular sessions with peer and adult counsellors.

As we detail shortly, the results of this phase of the project were, in the main, extremely positive. Although specific learning gains were largely modest, an important proportion of students in the treatment group became, as teachers noted, 'turned around' in their performance. All the students and families became far more committed to participation in their school than was the case for the comparison group (as measured by retention rather than disruptive moves to other schools). And with only two exceptions, all the families took excellent care of the computers, even when changes in family status or living arrangements presented formidable problems.

The college incentive phase

Officials of the Bell Atlantic Corporation (then known as NYNEX) and the BOE officials, with whom we co-operated in project design, were extremely supportive and encouraged by the project's richly detailed and largely positive findings in its first phase. In consequence, the Bell Atlantic sponsors at the end of 1993 agreed to continue the project through the students' high school years and to offer a \$2 500 scholarship to all students who graduated and met college admission requirements. This high-school phase of the research is officially referred to as the Project TELL College Incentive Programme.

In the middle-school years, from 1990 to 1993, our students and the comparison group students were attending five schools. But when they entered high school they were dispersed over more than 40 different schools. Due to moves within the city, the metropolitan region, and out of state, and to changes in some students' family status and living arrangements, we lost touch with about 30 families between middle school and high school. It was no longer possible to keep track of both the TELL students and the comparison students. This situation established a 'natural experiment', because for the TELL students with whom we remained in contact, it became possible to continue developing our 'on-line learning community' based on e-mail, chat and bulletin boards, which would offer these now dispersed students an opportunity to stay in touch with the project and with each other through the networks they had access to and were familiar with since their middle-school years. With the encouragement of our collaborators and sponsors, we placed more emphasis on developing on-line learning experiences and in seeking ways to use the technologies to stay in touch with our students and their parents. The central focus of this phase of Project TELL was to motivate our students to make more effort in school and to begin to think of themselves as 'college bound'.

Over the past four years, while our students were in high school, we have been experimenting with computer-mediated tutoring systems (on the networks) and have relied on the communication networks to keep the dispersed group together as a project. We no longer were able to run weekly meetings after school, but have been meeting at least once a month since 1994 at Saturday workshops where we deal with technical issues, repair and upgrade equipment, introduce more advanced computer skills, schedule on-line tutoring sessions, develop job resumes, write and edit college application essays, comment on Project TELL activities, and discuss issues of current events and school news through e-mail and chat sessions. Contact over the telecommunications network was an essential feature

of participation in the college-incentive phase of the project. Communication abilities which our students gained during the first phase of the project proved to be invaluable in maintaining lines of communication once the students were dispersed over the entire array of city high schools.

In June 1997, our students completed the four years of high school. In fact we knew of 34 students (out of 74 who continued voluntarily in the project through June 1997) who did graduate after the standard four years and attended college in the Fall semester of 1997. We expected an additional 10 to 15 TELL students to graduate by January 1998 and many of these will also be attending college. These graduation and college-attendance results are substantially higher than one would expect in this population.

It is quite clear, all qualifications notwithstanding, that many of our students had their educational lives changed dramatically by their mastery of technologies that they otherwise would not have had much exposure to. The direct effects of time on writing and reading tasks through participation in computer-based telecommunications networks do explain a good deal of the positive results, which we report in the results of Project TELL's first phase, to which we will turn, after this commentary on the implementation. The implementation of the project was undertaken by the Stanton/Heiskell Center.

Implementation of the programme

As a longitudinal study over seven years, the effective implementation of such a broad-scale project required a great deal of co-ordination and human resources, as well as a wide variety of services and equipment.

Bell Atlantic, which provided the major funding for the implementation of the seven-year Project, was represented in the first phase of Project TELL by a full-time Project Director to assist in co-ordination

and technical assistance. Bell Atlantic also provided hardware, training personnel, jobs for students, and workshop space. The BOE committed senior staff to serve as resource people, provided and managed the instructional telecommunications bulletin board system, NYCENET (the BOE's telecommunications network for New York City public schools), First Class (the BOE upgraded network), and assisted in the identification of teachers to serve as tutors.

The Stanton/Heiskell Center at CUNY was responsible for the creation of the research design and oversight of the administration, management, implementation and evaluation of both phases of the project. This included programmatic content, activities for the students, training teachers and students, outreach to the parents, and communication with the collaborators. Monthly advisory committee meetings were held with senior staff of the two partners to discuss issues, procedures and co-ordination.

The CUNY research and technology teams were composed of the Director of the Center, CUNY doctoral faculty in Sociology, Psychology, and Anthropology, a Technical Assistant Project Director, a Staff Developer, and a part-time staff of CUNY doctoral students from diverse disciplines (Sociology, Psychology, English, Political Science, Education, Computer Science, Anthropology, Drama, and Management) serving as technology, research, and administrative assistants over the course of the study.

The Center worked closely with both partners to insure good communication and co-ordination. During the first phase of the project, Bell Atlantic assumed an active role in responding to the technical demands of the project. The company arranged for the purchase of the IBM hardware, installed telephone lines in the homes without phone services (10%) and identified corporate trainers to assist the Stanton/Heiskell staff with the initial technical training of students and teachers. Many training sessions were held at the Bell Atlantic facility. During the

second phase of the project, Bell Atlantic provided space for the monthly workshops and donated upgraded 386 PC computers. Briefings were held with senior management to report on our progress.

The BOE's main role, during both phases of the project, was to serve as an intermediary between the school, the BOE Central Office and the Stanton/Heiskell Center to assure smooth communication and coordination. The BOE staff were available to respond to technical problems that arose on the network, or when necessary, to intercede with teachers and/or students when problems arose in the school. In addition, teachers who volunteered to become paid tutors were recruited in the school. The support of the Central Board was crucial to gaining access to student academic records for the project evaluation. (Parental consent was also required).

The project costs were approximately \$300 000 per year, excluding the initial purchase costs of IBM hardware. These expenses included personal costs for staff: principal investigator, project director, staff developer, tutors, research assistants, and other than personal costs (OTPS): computer upgrades, software, hardware for repairs, office supplies, travel, postage, phone, publication costs, etc. It is important to note that hardware costs have dramatically decreased, which should impact favourably on the funding of future projects.

In the first phase of Project TELL (1990-1993), 125 girls and boys who had scored between the 50th and 25th percentiles on their standardized reading tests in the Grade 5 were invited to become students in the project. This selection criterion was suggested by the New York City BOE, for which it is a definition of students who are 'at risk' of later failure and early school leaving after the middle-school years. Students in the treatment group were chosen at random from the pool of eligible 'at risk' students in five middle schools located in each borough. The students were matched to a comparison group with similar test scores who also attended the same middle schools.

In a few cases, students selected were slightly over the 50th percentile limit. This occurred where the pool of eligible students and those matched for the comparison group was exhausted in the random assignment process. We also attempted to minimize the number of students scoring below the 25th percentile to the degree that eligibility pools in the five schools allowed this. We did so in an effort to minimize the presence in the treatment group of students with specific learning disabilities. Although we strongly believe students with learning disabilities can benefit greatly from use of home computers, we simply did not have the resources to include learning-disabled students in the intervention (National Council on Disability, 1996). Low scores on Grade 5 reading exams hardly exhaust the range of risks faced by adolescents in economically depressed communities (Williams and Kornblum, 1994).

Once we had selected the students (59 girls and 66 boys), we quickly began to learn about the importance of additional risk factors in their lives. Many students lived in neighbourhoods with extremely high crime rates and visible street drug activity. For these boys and girls the home computer often became a refuge from the street and in a sense a means of escape from the neighbourhood into other worlds. We also began to learn rather quickly about relative advantages enjoyed by some of the students in comparison with others. For example, in our intake 57 students (46%) reported that they lived with both parents. The majority reported that they lived with one parent, grandparent, or guardian. Fifty-five per cent of the students reported that a language other than English was spoken in their homes. In 82 per cent of these households Spanish was the primary language. It should also be noted, however, that only 12 students reported that they themselves typically speak Spanish in the home, an indication of the tendency for students of the foreign born to speak English by preference where possible.

Project TELL students typically come from homes in which there are a larger than average number of siblings. The mean number of persons per household among TELL students (4.5) is far higher than the NYC average of 2.5 persons per household, and ranges from 2 to 15 persons. If we could compute the number of persons per room in TELL households we would no doubt also find that a great many of the children enjoy far less personal space than children from more affluent homes. In many cases when we made home visits to TELL families to repair equipment or to discuss some aspect of the project with parents, we learned that at least 30 per cent of TELL children shared small bedrooms with two or more other siblings or cousins. We also visited homes in which TELL children live with a parent and older and younger siblings in one or two very small rooms. In these cases the computer represents a large commitment of family space and there were many home situations in which the lack of adequate space for the computer became an obstacle to its use. But in many of the most modest homes, as noted earlier, the computer very often became a vital window to the outside world of information and knowledge.

The Project TELL students were given an IBM PS2 computer, colour monitor, printer, stand, modem and access to two networks: NYCENET, and Project TELL ON LINE, a private service. Both systems offered e-mail, real-time chat, games, educational resources, and access to a larger network of youthful and adult subscribers. Only three or four of the households had a home computer at the time of initial selection, and these were not equipped with modems or internal disk drives. When students and their families were informed of the opportunity to join Project TELL they were most enthusiastic. Only two or three refused the opportunity to participate, mainly due to worries about protecting the equipment.

Each computer came with a standard package of software. The programmes were accessed through a standard Project TELL menu which appeared immediately on each student's screen. The menu, which

was designed by the Project TELL technical staff and installed on the students' computers, provided an interface that simplified the students' use of the technology. Using the menu, students could select from a variety of software programmes. The software included Microsoft Works (for composing documents), ProComm (for connecting to the NYCENET electronic bulletin board), Print Shop (for graphic designs, banners, and greeting cards), Mavis Bacon Teaches Typing (a typing tutor), and PC USA and PC Globe (Geography tutorials). The NYCENET system, administered by the BOE, provided access to databases, electronic mail (e-mail), and real-time chat (a computer-mediated communication system in which users who are logged into the system at the same time can write instantaneous messages to each other). Each computer also had software installed which allowed the TELL staff to edit batch files (automated computer programmes created by Project TELL's computer science doctoral students) from our central office and to document how often and for what purpose students (or other family members) were using their equipment. This programme was removed from their computers after the middle-school phase of the research, because at that point the equipment belonged solely to the students and their families.

The delivery and installation of the Project TELL equipment into the homes was a challenge in terms of security, space allocation, and basic care and maintenance. A major concern was the vulnerability of computer equipment in the homes, but only one computer was stolen. The equipment placed in the homes was more vulnerable to a common computer menace which the implementation team had not foreseen – namely, and literally, 'bugs'. Insects, attracted perhaps by the warmth of the equipment, damaged and destroyed a significant number of CPUs, keyboards, and printers. Unique challenges like these proved more troublesome than the threat of burglary or loss of the equipment; indeed, the security of the computers in the home appeared to be better than school security.

The TELL students attended a weekly, two-hour computer-user group in their schools after regular school hours. After-school user groups were run by two teachers from each of the middle schools who were assisted by members of the project staff. The purpose of these weekly sessions was to teach students how to use their computers, how to get on line, and how to ensure that students' equipment was in running order. Students were required to attend these sessions, although they were not eliminated from the study if their attendance was spotty. They also understood that if they finished the three years of middle school in good standing in the project, they would then own their home computer equipment. Students in the comparison group did not receive such treatment nor were they aware that they were in a study or a statistical comparison group.

The initial and ongoing training of students, teachers, and parents played a major role in the ultimate success of the project. Tasks as basic as untangling and correctly plugging in the complex set of electrical wires included in a basic computer setup were often daunting to teachers and families who had never owned personal computers. During the first phase, two-hour weekly user-group meetings were held in each middle school; and a Project TELL Telephone Helpline, located in the Stanton/Heiskell Center's Telecommunications Laboratory at CUNY and staffed by the CUNY technology team, was available daily for technical support and the discussion of problems.

During the second phase of the project, monthly workshops held at a Bell Atlantic training facility became the primary means of contact with the students, because the students graduated from five middle schools into over 40 high schools. Most TELL activities took place during these sessions. Technical support was administered to students with computer problems and, occasionally, equipment upgrades were performed. In the Bell Atlantic computer laboratories, students received hands-on instruction for software including First Class, Microsoft Works

(word processing), and Netscape Navigator (web browsing). On-line and face-to-face tutoring sessions were conducted in every academic subject. In order to participate in the TELL Job Initiative, students developed employment resumes during the workshops, aided by TELL staff. Since many students had difficulty receiving sufficient help from their schools' college counsellors regarding college admission and financial aid processes, information sessions on these topics were presented by experts in the field.

Outside of workshops, off-line activities included college tours of Hofstra University and CUNY's City College (CCNY), when students garnered the opportunity to learn about college life in general as well as to explore specific campuses and their educational offerings. Other field trips were conducted, including visits to the corporate headquarters of IBM and Bell Atlantic, where students witnessed real-life applications of computer technology. In the final year, a weekend-long retreat to Boys Harbor Camp in Long Island, NY, was conducted, where trained counsellors led the students in a variety of esteem-building and goal-setting exercises. The activities encouraged supportive friendships among the students, most of whom attended separate schools, and offered incentives for continued involvement in the project.

A major task for the TELL staff in the last year of both phases of the project was designing and preparing a 'transitional packet' of materials for principals, teachers, students, and families to help reinforce the skills and knowledge that they had gained throughout the project. As planned at the outset of TELL I, the computers became the property of the families after the conclusion of the third year. In order to help families cope with the day-to-day difficulties that can arise when using computers, a maintenance manual that addressed the problems most commonly encountered by computer users over the course of Project TELL, titled *I'm on my own*, was developed and distributed to the participants. In addition to the printed manual, all participants

received a new version of the start-up diskette originally included with their machines. At the conclusion of the project, a revised edition of *I'm on my own*, updated with information about the upgraded computers and software, Internet providers, and other technical topics, and a Project TELL yearbook, organized by a student committee and edited by the staff, were distributed. A graduation ceremony celebrating both the students' completion of Project TELL and their personal graduations from high school, featuring former Federal Communications Commission Chairman Reed E. Hundt as guest speaker, was held at the university at the end of the school year.

HOME COMPUTERS STIMULATE EDUCATIONAL ACHIEVEMENT: EFFECTS OF THE PROGRAMME

Problems and obstacles

Project TELL students made gains in school achievement which were directly attributable to their access to on-line networks during after-school hours and on the weekends. Phase one of the project, as noted above, compared school achievement for TELL students with a matched sample of middle-school peers who did not receive the equipment.

- **Gains in verbal ability for TELL students**

At the peak of their use of the computers during the school year (in Grades 7 and 8), students averaged 20 minutes a day on the computer networks. Students on the high-use end of the distribution were often on line for more than an hour daily. This was before they had access to the World Wide Web or other attractive graphic environments and before the Web became as popular as it is today. Our students were interacting at high rates, especially in real time 'chat' situations. They wrote every day to other students, their teachers, and adults whom they met on line. Although students call these interactions 'talk', they are required to read and write to communicate via the keyboard and the computer. We could immediately document how these voluntary and compelling communications positively shaped their writing by forcing them to pay more attention to punctuation and to the clarity of their expression. Many of the students also participated in interactive storyboards which also improved their writing ability. Even the less active network users learned to touch type and gained a facility with the computer disk operating system (DOS) and the techniques of uploading and downloading files, which are rarely found in this population of disadvantaged public school students. There is also no

question that in the contemporary economy, a basic facility with the techniques of computers and telecommunications is an advantage in a student's access, not only to career opportunities but to new frontiers of knowledge as well. Many TELL students understood this or came to do so during the course of our on-line experiences.

We spent many hours with the students in school and in their homes, thus accumulating a great deal of information about the range of computer uses and changes in behaviour in the student group and among their siblings and their parents. The project also held a limited number of highly successful parent workshops to teach the basics of word processing and the use of personal computers. Most members of the TELL staff agreed that if resources had permitted, we would have potentially reached even more students by extending more training opportunities to parents and siblings.

Figure 1 presents the summary data about change in scores on standardized tests of verbal ability for TELL students versus the matched comparison group. Note that for both groups the average reading score (expressed in percentile on the national norms) declines quite dramatically between the Grades 5 and 6, as students make the disruptive transition from primary to middle school. For the comparison group, these scores improve somewhat over the three middle-school years but never attain the Grade 5 level. For TELL students, however, the situation is quite different. Their average score increased markedly between the Grades 6 and 7 and there is a small net gain between the Grades 5 and 8 (36.4 - 38.7). (The Grade 7 group's mean differences are significant at the 0.015 level.)

Improvements in average reading scores for the TELL group, a sceptic might argue, are rather modest and do not exceed the 50th percentile. But these group means mask the performance of 28 TELL students who

made dramatic gains of over 15 percentage points in their reading scores and often went above the national mean. *Figure 2* compares histograms of Grades 5 and 8 reading scores where the influence of these 28 students is clearly evident on the right side of the graphs. Analysis of the actual writing and its volume for these students, when they logged in to one of the two communications networks and sent e-mails to us, clearly establishes a direct link between communication over the networks and improvements in verbal abilities.

Figure 1: Project TELL reading scores for Grades 5-8
Project TELL versus comparison group

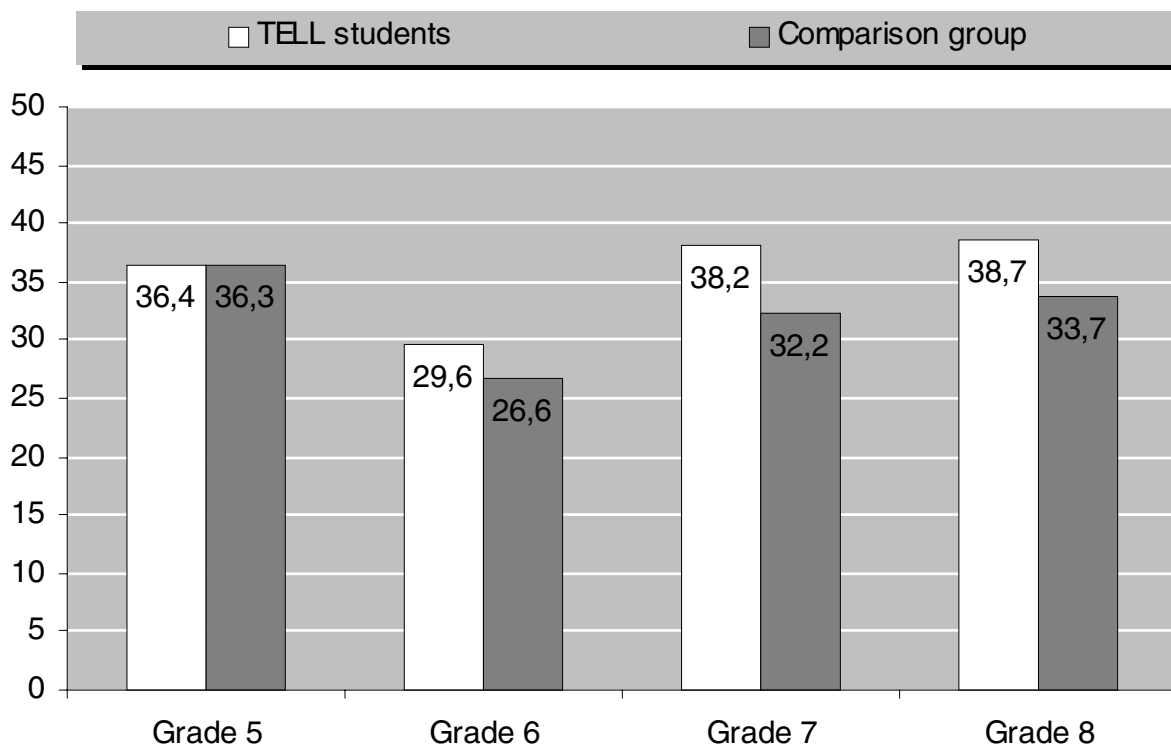
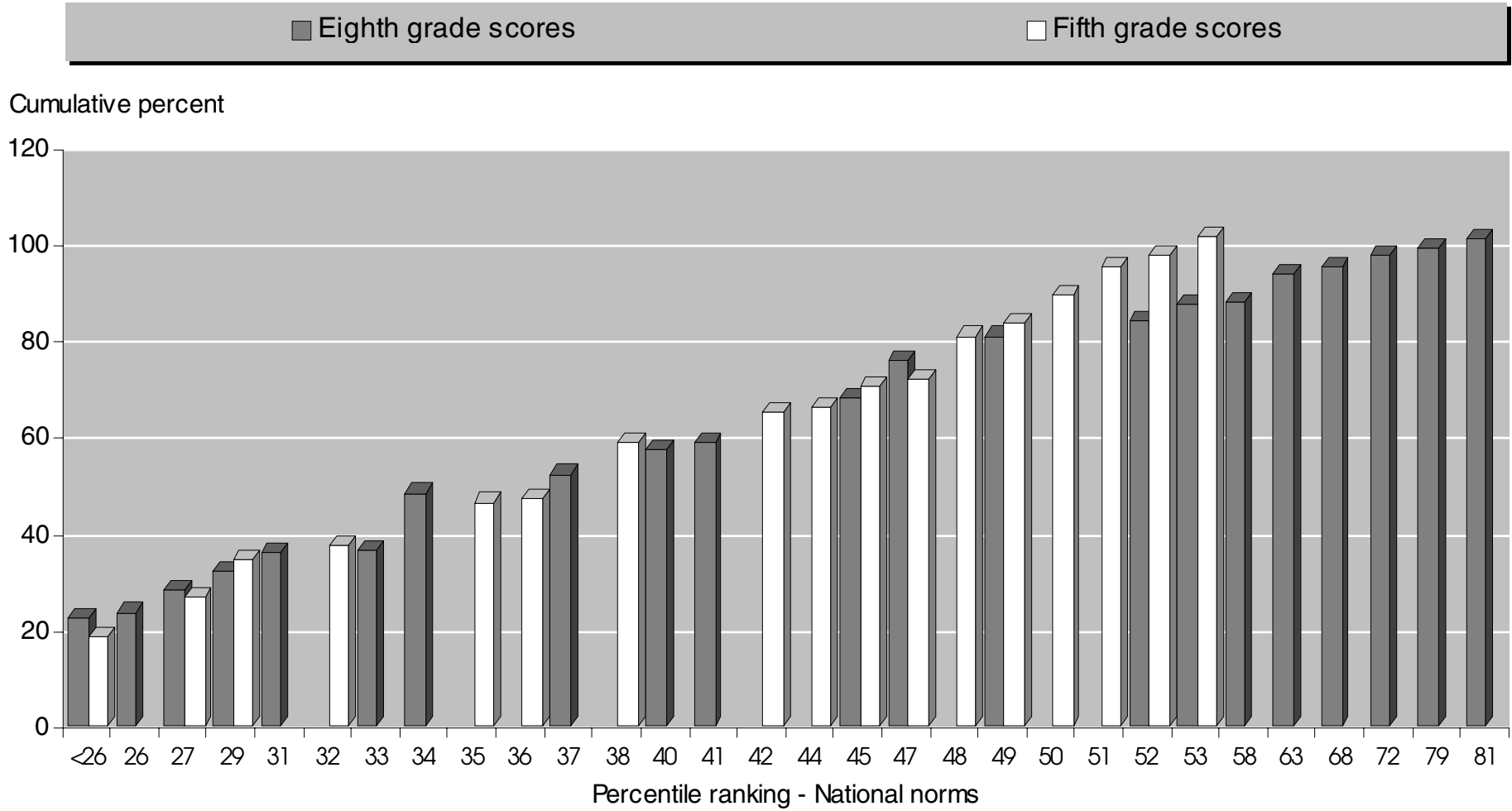
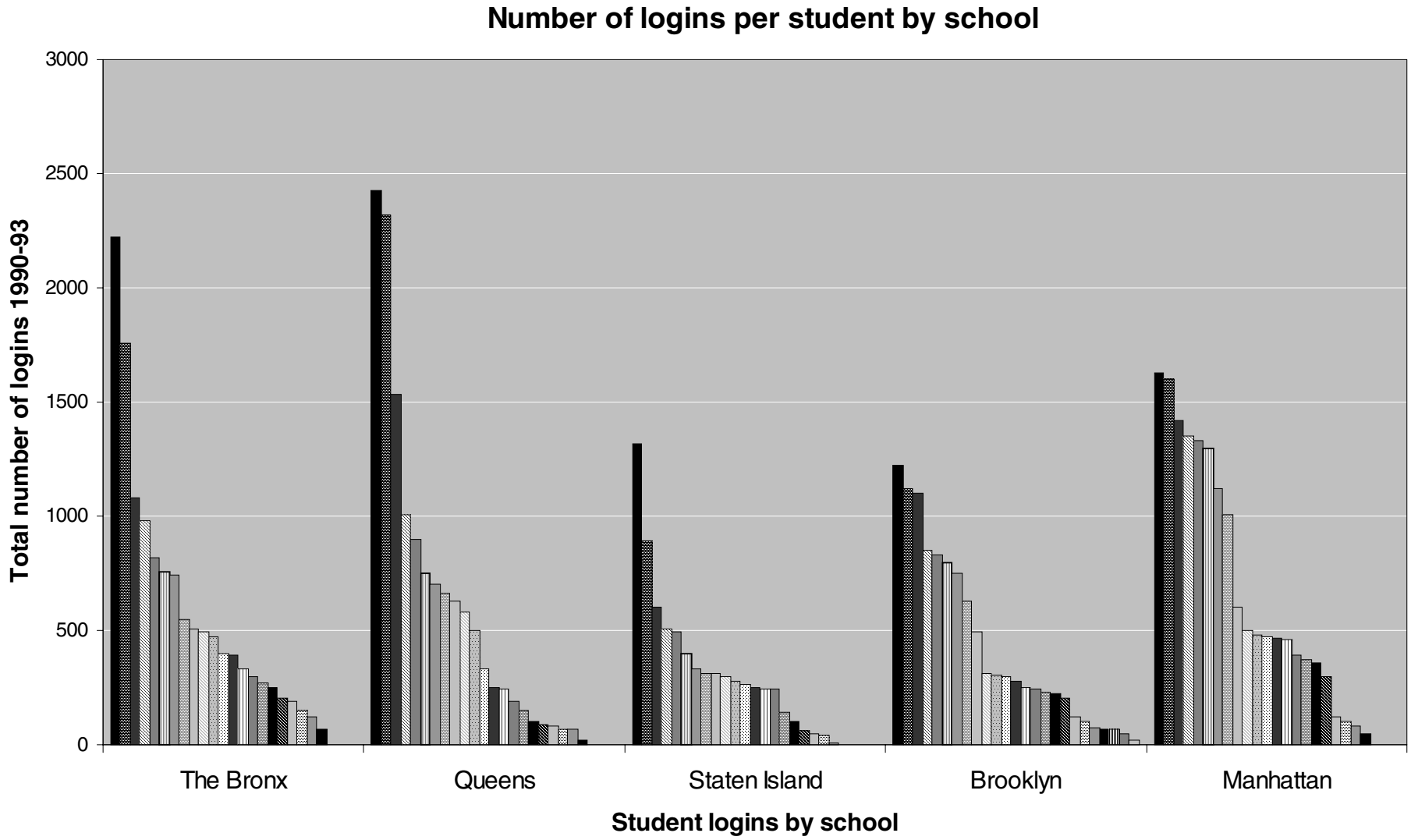


Figure 2: Project TELL reading scores: Grades 5 and 8 percentiles



Attacking urban poverty: how universities can help
Project TELL: telecommunications for learning

Figure 3: Project TELL NYCENET usage



- **School performance and time on line**

TELL students who made the greatest gains in school spent more time using their home computers and engaging in on-line network activities than others did. All on-line activities involved reading and writing in the symbolic environment of computer networks. At its height of popularity in the Grades 7 and 8, TELL students spent an average of almost 20 minutes a day on line, but again, these averages mask a more important result. *Figure 3* shows that TELL students varied greatly in the amount of time they spent on line. Each of the bars in the figure represents the number of times an individual student logged in to the school system's telecommunications network, NYCENET, where TELL was afforded its own area with bulletin boards and e-mail. Students could then go to other menus on NYCENET to engage in real-time chat 'discussions', to conduct research using the on-line encyclopaedias, and download games or software. In each school, as the graphs indicate, there were a handful of heavy network users who tended to log in every day and spend hours reading and writing, which they unlikely would have done otherwise. With only two or three exceptions, these students became the core group of those who made gains in school performance and eventually graduated from high school and are attending college.

The graphs also show that there were students in each school who hardly ever participated in the computer networks. While they may have been using their computers as freestanding equipment, the data we have on usage indicate that for the most part this was not the case. This low use of networks by some TELL students, and lower use of their computers more generally, had a number of explanations. In many cases these students lived in homes where the phone service was highly problematic. Often it was physically difficult for students to connect their modems into the family phone, especially if that phone was in a relative's apartment, as often turned out to be the case. Bell Atlantic supplied us with separate lines only for network use in these cases, but

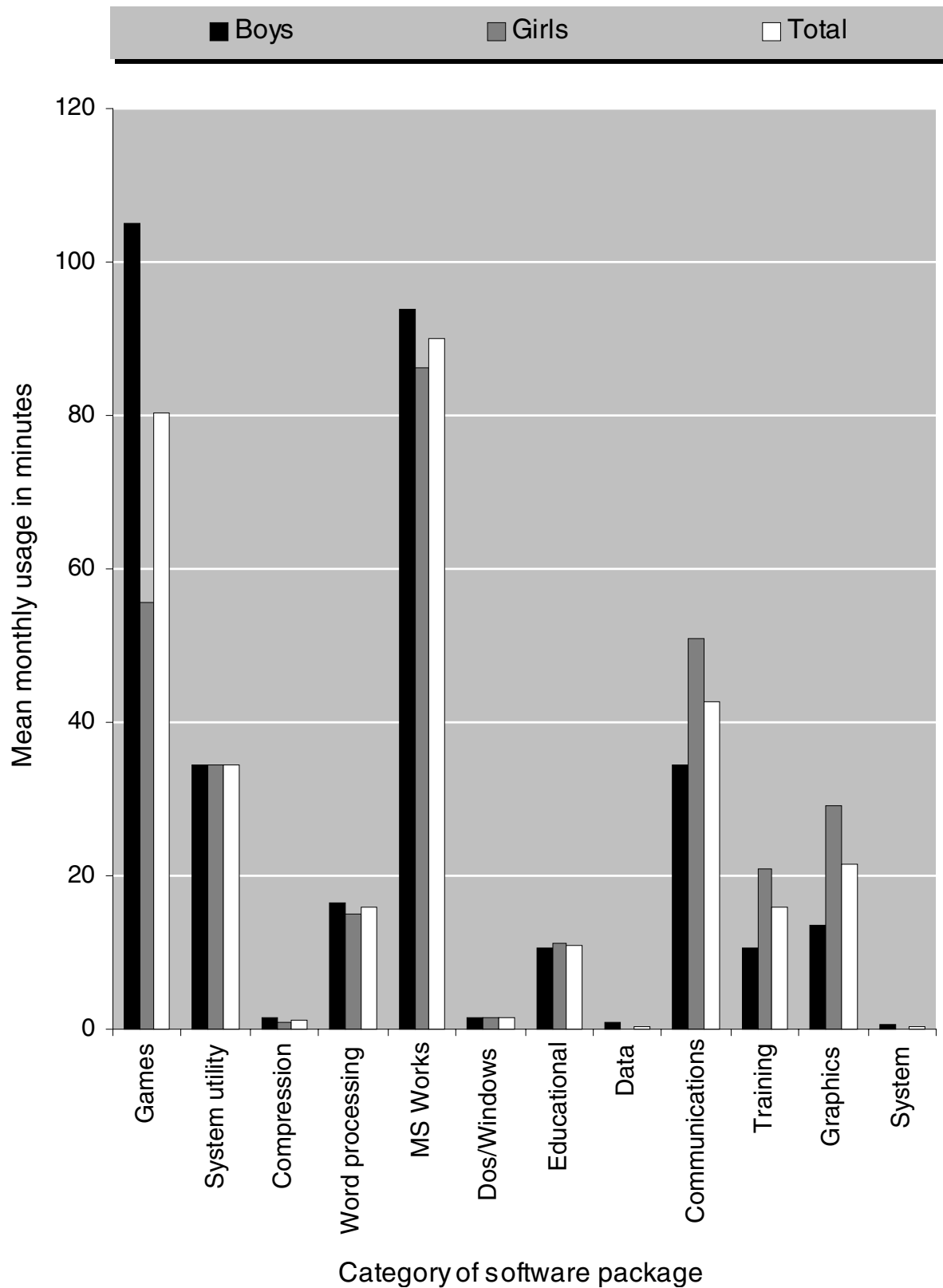
there were often difficulties in securing these lines from uses by visiting kin and friends. In other cases, even this special phone access was disrupted by family dislocations and many months would pass before we could reestablish phone access.

In still other cases, approximately 15 per cent, the computers and network access simply did not appeal to the student or lost their appeal after the first year. There may have been other attractions in the streets, competition from jobs, baby-sitting or working outside the home, and many other competing activities, including television. It should be emphasized here that TELL students were not selected from a universe of students who had volunteered to work with home computers and networks. Random selection meant that there would be a range of behaviours toward the technologies, including almost indifference born out of early and continual frustration.

- **Gender and home computer use**

We found essentially no gender differences in students' use of the technologies or their interest in computers and the Internet. Research conducted in school settings often finds strong gender differences, with boys seemingly more interested and active users than girls (Brunet and Proulx, 1989). The fact that they had access to the computers and networks from their homes, on the other hand, seems to have mitigated this gender effect. While the girls were somewhat less likely to play action games on their PCs, they were no less likely than boys to express an interest in computers and to demonstrate that interest by spending time on line and at their keyboards. By the end of the middle-school phase of the project, there were at least as many girls as boys in the top third of computer and network users and just as many girls who expressed an interest in learning more about Computer Science as boys.

Figure 4: Project TELL resident software usage mean
Monthly usage in minutes by gender



STIMULATING COLLEGE AMBITIONS: PROJECT TELL'S SECOND PHASE

High school graduation and beyond

Out of the original 125 students who were selected for Project TELL in 1990, we currently know the whereabouts of 105. The others have either moved from the area or are at unknown addresses in New York City. Out of these 105 students, there 74 who have voluntarily been active in Project TELL during their high-school years, the College Incentive phase of the project. Of these, approximately 60 appeared to be certain to graduate from high school either in June 1997 (after four years) or in January/June 1998. Thirty-four TELL students (46% of those 74 students active in the second phase of the project) graduated with their class in June 1997.

The New York City high schools presently graduate 49 per cent of their students within four years. This figure includes all students. Project TELL students, however, were considered to be 'at risk' of school leaving due to verbal test scores below the 50th percentile. The BOE does not publish statistics on graduation rates of 'at risk' students, but it is certainly far lower than the overall average. In addition, with only a few exceptions, Project TELL students are either African American or Hispanic. The graduation rate for all minority students from NYC high schools is 41 per cent, lower than the graduation rate of TELL students who participated in the College Incentive phase of the project.

Among the interventions during TELL's second phase, which help account for the relative success in high school completion and college applications, the following must be noted prominently:

- The interaction of in-person and on-line learning activities
- On-line and in-person tutoring
- Computer upgrades for network access

- A job opportunity programme
- On-line and in-person college counselling.

The following discussion highlights the contribution of each of these interventions to the overall Project. But each deserves a more detailed and critical analysis, which they will have in subsequent TELL papers devoted to them as major subjects.

On-line and in-person learning activities

During the students' high-school years we conducted monthly workshops at a telephone company training centre in the Chelsea community of Manhattan. These sessions were devoted to workshops about computer and network skills, assessment of student progress, motivational activities and encounters with exemplary young adults, peer socializing, school and college counselling, discussions with parents, and tutoring in Mathematics and other subjects. All these activities were scheduled as needed, based on discussions among staff and TELL students.

We had learned in the first phase of the project that on-line contacts and activities are not a replacement for in-person gatherings. In fact, on-line communication greatly heightened the desire of adolescents (and adults) to actually meet each other. The on-line learning community had formed peer relationships, mediated by e-mail and chat, among TELL students who lived at relatively great distances from each other within the city. The opportunity to actually get together and see each other became, over the years, an increasingly motivating experience for further participation in the project. As the students became capable of using mass transit to travel to a central location, it became possible to use our monthly workshops for a range of activities that would stimulate the students' continuing participation in on-line activities and would motivate students to complete major academic steps, such as passing

required competency examinations and, in many cases, more advanced New York State Regents examinations.

Annual field trips and a weekend retreat, where students tested themselves in Upward Bound challenges, also served to create a core of students who began to take leadership roles in the project. Eight of these students also participated in a summer Youth Travel Initiative in Costa Rica and Ghana, where they worked with host country peers in rural development projects. This proved to each to be the outstanding learning experience of their high-school years, and one which stimulated them to renew their efforts to communicate with others in the project and elsewhere over the networks.

On-line and in-person tutoring

TELL students who actively participated in the project's phase two activities could avail themselves of tutoring opportunities by making contact on line with professional tutors (New York high school teachers and City University graduate students) in the academic areas with which they needed help. Students and tutors were able to communicate on line about specific tutoring needs and were able, in some cases, through the use of e-mail and chat, to actually exchange work and learning exercises.

These on-line tutoring resources tended to be underutilized. Especially in Mathematics, the limitations of existing networks did not allow for efficient communication using mathematical notation. In the last year of the project we were able to begin experimenting with new tutoring software, but earlier efforts at on-line tutoring mainly resulted in establishing relationships between tutors and students which could be followed up on at workshops and in phone conversations. Our continual emphasis on the students' tutoring needs, however, did clearly focus attention of students' family members on the project's desire to help students complete high school.

Some of the limitations of our tutoring efforts were technological. Students' computers needed to be upgraded so that tutoring and practice in Mathematics and other subjects could be based on more effective software systems. But there were other extremely pressing reasons why upgrades became a major challenge for Project staff and students, that had to do with the breakneck speed of change in the nature of telecommunications networks and the personal computers used to access them.

Computer upgrades: keeping pace with the technology

Monitoring students' school performance and their growing computer competencies was vastly complicated by the students' own maturation from early to late adolescence. We often believed, for example, that we were losing some students due to lack of interest in on-line participation, or lack of attendance at our group sessions, only to find that the same students would appear again with renewed determination to participate in the project. Most often their explanations were that personal or family problems, particularly sibling child care responsibilities, or work (for pay) obligations, had been keeping them away. And even more often, their failure to participate was due to problems with maintaining their equipment in working order or problems the family was having in maintaining a regular phone service in the home. It was essential to the success of the project, therefore, that we created an environment in which students were continually encouraged to renew their participation and that we refrained from dismissing students for non participation. But perhaps the most serious obstacle we faced over the seven years of the project was the sheer rapidity of the technological change in telecommunications and computing. These changes made it imperative that we devote a great deal of effort to improving the students' computers, an extremely difficult chore.

When our students received their equipment in the Grade 6, IBM PS2 computers and 1200 baud modems were top-of-the-line consumer-level products. Two or three years later they were essentially obsolete (although for home use they remained quite valuable). Most networks, including NYCENET on which we depended, were abandoning the older text-only environment in favour of a Windows and graphics environment. To keep our students engaged on the network and to offer access to the highly visible and exciting World Wide Web, we desperately needed to upgrade their computers to at least 386 machines which could run a version of Windows compatible with the upgraded NYCENET system. Again, our invaluable corporate sponsors came to the rescue. They provided the used 386 computers and the budgetary resources necessary to equip these reconditioned machines with more powerful modems. However, when we wanted to experiment with newer tutoring software in the project's last year, we were able to purchase Pentium computers with faster modems. We based priorities for distributing new equipment, as it became available, on evidence that students were participating in the project's on-line and in-person activities and their need for more advanced tutoring support on the Web. This policy created strong incentives for more consistent participation in the project and more attentiveness to schoolwork. For many students, this additional academic support enabled them to achieve higher scores on the standardized tests. Students also were aware that conscientious participation in project activities would help them compete for a limited number of summer and after-school jobs, for which the project staff were able to make referrals.

Monitoring the students over the seven-year duration of the study presented challenges aside from the disturbing problem of continual computer upgrades. Although the BOE furnished us with home addresses (with the consent of the parents), families frequently moved

without providing us with their new addresses. The TELL staff developed a sophisticated communication system to track students whereabouts that included e-mail, phone, teacher and/or peer networking.

Our tutoring programme had to acknowledge the fact that (1) students did not have a realistic perception of their academic weaknesses and (2) students often did not realize that they needed help in a specific subject until it was too late. Staff conferences were held with students to help them build self-esteem and overcome their resistance to academic help. On the other hand, the students' lives were full of distractions, an additional complication. The programme was competing with a myriad of activities for the students' attention, e.g., sports, baby-sitting, TV, 'hanging out', jobs, etc. However, the vast majority of homes were supportive of the TELL programme and their children's progress.

Work opportunities through Project TELL

Students from inner-city communities are often completely unaware of how to go about seeking part-time work, a trait they share with students from most other backgrounds. But TELL students share with thousands of others from dense, inner-city neighbourhoods the limited personal or family resources which can lead to part-time work of any kind. At the same time, they have intense needs for spending money, without which it becomes impossible to dress in what they consider appropriate fashion or to explore the city without jumping turnstiles. Against this particular dearth of opportunity the computer often became a small profit center. In the middle-school years, frequently there were students who discovered for themselves that knowledge of computers could lead to income opportunities. Quite a few students in the Grades 7 and 8 reported using programmes like Print Shop to do party banners

and cards for neighbours who paid them small sums. These were extremely gratifying experiences for these students and often reinforced a perception that knowledge of computers and their software could lead to jobs and income opportunities. The project staff never advertised computer skills as essential for job preparation. Our emphasis tended to be far more on computers as aids to the education process. But parents, teachers and peers often spoke about the job-related aspects of computer skills and many of our students also believed in this connection.

In their second year of high school, when they were 15 and 16, we developed an on-line résumé bank. At workshops and on line, students were instructed in how to develop a résumé. They were asked to download their draft résumés to the project office over NYCENET. These drafts were edited and sent back to the students by e-mail with an attached file for revision. Through this process we reinforced knowledge of the techniques of moving documents over the networks for a purpose that was immediately reinforcing to the students. As we arrived at acceptable versions of the students' résumés, these were posted on line and sent to prospective employers. At any given time during the second phase of the project we had 10 to 15 students in part-time employment in the university, in their communities, and in some interested corporations. During the summer, the Bell Atlantic Corporation employed at least 10 TELL students who passed their rigorous screening examination. Every student who worked on a part-time job through Project TELL, reported that basic knowledge of computers and networks, word processing, databases and spreadsheets, modems and printer management were extremely useful skills even though these skills were rarely the direct requirements for employment. Many of these same skills proved to be extremely useful in the college application process.

College counselling and applications

The Project TELL learning community's on-line capabilities and adult resources were of invaluable use during the stressful process of college applications. As any parent of a college-bound student knows, this is typically a difficult period for the high-school senior and the entire family. Students face difficult or confusing decisions about where to seek admissions, how to study for the College Board examinations, how to apply for financial aid and how to write their essays. In the student population we worked with, these steps were particularly difficult due to the relative lack of resources to draw on for help in the application process. College counsellors are uniformly overburdened at most large urban high schools. The college counsellor may have 400 or more students to deal with, so the student who has waited on line outside the office may only receive the most perfunctory advice. Students with mediocre grades and Scholastic Assessment Test (SAT) scores are so numerous and so likely to procrastinate in the face of all the stress and uncertainty, that college counsellors naturally find themselves devoting the most attention to those students with the best admissions potential, and the most personal motivation to complete the application process.

Through numerous on-line activities, we continually reinforced and supported TELL students own efforts to apply to colleges. We worked with students at monthly workshops to begin writing college essays and helped frame these essays to reflect the students' achievements in the project and elsewhere. Once the students had the beginnings of the essays on the computer and posted to us through NYCENET, we could exchange drafts and comments on the work with students on an individual basis with relative efficiency. Our graduating seniors began to understand that their participation for the past seven years in a university-based telecommunications research project gave them distinct advantages in the application process, especially as their on-line tutors helped them incorporate writing about the project in their

essays. We were also able to advise students about the details of financial aid, including aid for college tuition from Bell Atlantic, which they receive upon enrolment, and opportunities for attending colleges out of the city through special financial aid programmes.

The success of this college application process can be measured by admission of Project TELL students to Georgetown, Syracuse, Wesleyan, Hofstra and many State University of New York and City University campuses: for a total of 24 admissions by June 1997, with others to be enrolled in Spring 1998. A number of TELL students, who might have attended college, chose instead to join a branch of the military service, where entry is now as competitive as admission to a four-year college.

In summary, these are highlights of Project TELL's second phase. But achievements like these depended entirely on the development of the learning community and student commitment to the project. That commitment, in turn, was only made possible by the activities of a dedicated staff. Computers and information networks greatly facilitated all aspects of our work with the students and their families, and it is certain that possession of computers and development of technological skills were powerful motivating features of the project. But continual involvement of concerned adults in the lives of TELL students, through direct contacts and over the information networks, was essential to each student's progress toward higher education.

IMPLICATIONS OF PROJECT TELL FOR FUTURE RESEARCH AND ACTION: CONCLUSIONS

Results of the first phase of Project TELL make a convincing case for immediate measures to more equitably disseminate computing and network capabilities to the homes of families with children in primary schools. With the requisite adult involvement in the development of on-line learning communities, it should be possible to prevent underachievement and school failure in at least one-third of those homes where children are falling behind as their verbal abilities and motivation to do school work falters. This may strike some readers as an almost utopian statement, and there are ample observers of computers in education who believe with some reason that the benefits of these technologies are currently oversold (Oppenheimer, 1997; Stoll, 1996). It is also true that there are many possible interventions, including direct provision of tutors, motivational Upward Bound-style experiences, after school programmes, and others which could also, if adopted in given communities, have similar if not even more robust effects. The Project TELL research demonstrates, however, that home computers and Internet access, along with training in their use and continual adult and student interactions in an on-line learning environment, can also 'turn around' a significant number of underachieving inner-city students. And the same intervention, based on a single investment in the technologies, can work for other siblings in the family, and can have important implications for adult members of the family by effectively lengthening the school day while bringing new forms of entertainment into the home.

In consequence, the following recommendations can be justified by the direct implications of Project TELL and related research.

1. Encourage early family access to information technologies

There is a good deal of research which shows that gains children make in pre-school programmes and other early educational enrichment interventions begin to degrade after three or four years of primary school (Houk, 1997). Clearly there are no magical formulas to reverse these declines. Nor will access to computers and information networks (with dedicated adults involved in them) reverse these declines in all students. But we have shown that for a significant proportion of students, the information technologies at issue here can compete with television and the lure of the streets for students' attention. There is every indication that the array of educational experiences available on the Internet will improve exponentially in the next few years. In the seven years during which Project TELL has operated, for example, we have seen the industry finally move away from standard 'drill and practice' software for tutoring at all levels to far more interactive and diagnostically sophisticated learning software in most disciplines.

Project TELL students made immediate gains in the length of time they spent reading and writing because of the interest they took in writing to peers and adults over telecommunications networks. There is no reason why this same experience cannot be replicated with even younger children. By Grades 3 and 4, if not sooner, children are capable of navigating their way around computers and information networks (Papert, 1994; Skinner, 1997). If they are to be effective as educational interventions, however, these activities require careful planning and on-line adult involvement. In the ideal situation they also benefit from close integration with the students' actual schools and teachers.

It is probably only a matter of time before there will be applications and programmes available to children on the Internet, which have the mass attraction and educational impact that television programmes like *Sesame Street* had in their early years. A central question in this regard

is whether children from low-income homes will share in the discovery and actual development (as audiences) of such resources. Part of the answer to this question will depend on how well the information technologies are adapted to the needs of students and teachers in urban settings, and especially those in inner-city school districts.

The students expressed their feelings in a series of conclusive interviews as well as short essays for the TELL II Yearbook. Significantly, the students were not only appreciative of the computer skills they learned, but also noted a change in their educational outlooks. One student commented, "Project TELL has affected me in a positive way. It made me get more serious about life. ... Before Project TELL, college wasn't one of the main things I was looking forward to." Another explained, "Not only have I learned a lot about computers, but Project TELL has left me thinking about my future and my goals and helped me to work towards them." "Project TELL has taught me how to use computers better", another student stated. "It opened my eyes to the college world. It gave me the opportunity to learn about college and now I'm ahead. ... I'll be ready to graduate with the confidence and knowledge about college." "I love P-TELL", one student exclaimed.

New technologies like WebTV may be a means of providing basic access and computing needs to allow more families and students to share the experience of participation in on-line learning communities. Even could they afford to do so, few families with modest or low incomes would be well advised to purchase Pentium-type computers with all the necessary trimmings and subscriptions to Internet providers, while there is the risk that in a year or two all this equipment may become obsolete. The terminal and low-cost Internet service promised by direct TV applications may be at least a good interim approach. But to determine if this is so will require further research and demonstrations such as Project TELL.

2. Continue demonstration research to address issues of technologies, cost and software

At the time of writing, the Texas State Education Department was seriously considering the possibility of providing all its primary school students with a laptop computer. This easily portable instrument can contain all the student's school books and school work, be a link to a far wider world of knowledge beyond the classroom, and make students feel their schooling is oriented to their needs in the future as well as those of the present. It is unlikely that this proposal will be adopted without further planning and demonstration research. Yet even the fact that it is being seriously considered in one of the nation's largest school administrations, is an indication that it is time to look seriously at how to more effectively and equitably extend the educational benefits of computing and telecommunications technologies to American families. In the present environment of rapidly changing computer and telecommunications technologies, this is a considerable problem.

The Stanton/Heiskell Center is in the process of planning for the next phase of Project TELL. Project TELL III will create a model neighbourhood-based technology learning centre which will serve as an extension of the school day for students, K-12 and focus solely on academic achievement and preparation for meeting academic standards and benchmarks, with college as a stated goal. Located in an existing community centre or library, the learning centre will operate after school and on weekends. University faculty and graduate students will work closely with schools and community groups in a defined neighbourhood to rally the human, technological and financial resources of the community behind the academic achievement of disadvantaged students. Funders will also be encouraged to serve as mentors and technical experts. **We estimate that the neighbourhood learning centre will serve 1 500 to 2 000 students a year at a cost of approximately \$230 per student.** A structured 15-week tutorial

course will be offered. Negotiations are under way to identify cost-effective computers that parents can purchase for the home at the end of the tutoring sessions so that students can stay in contact with the learning centre.

TELL III will target at-risk, low-income minority and immigrant students. The site for the learning centre will be chosen in collaboration with the BOE, taking into consideration factors such as the percentage of at-risk students in the school district. Students failing to meet grade level will be referred to the programme by teachers at neighbourhood elementary, middle and high schools. Parental consent will be mandated, and parental participation encouraged.

The overarching goal of TELL III is to use a range of computer-based technologies and more traditional interventions to help students improve their reading, writing, communication, analytical, and mathematical skills, thus improving their overall academic achievement. TELL aims to enable students to meet grade-level requirements, improve their performance on standardized tests, and pass Regents classes, resulting in improved graduation and college acceptance rates. TELL's neighbourhood learning centre will provide access to the newest technologies, demonstrating the educational value of computers to large numbers of low-income families. Student progress will be monitored. The centre will be designed as a cost-effective model for similar centres in communities globally and will promote policy discussion around issues of education and technology access.

3. Incorporate on-line learning opportunities in plans for educational reform

New York State's Board of Regents has recently announced an ambitious new set of requirements for high-school graduation. These will require far more rigorous Science, Mathematics, foreign language,

and English standards and tests. At the same time, there has been insufficient effort made or resources developed to assist students and teachers in meeting these more demanding requirements. Similar changes are developing throughout the United States. The New York City public schools and other large urban systems are struggling to comply with these new requirements, usually in the face of diminishing resources and continuing attacks on public education. **There are no quick 'techno-fix' solutions to these problems.** On the other hand, it is clear from the results of Project TELL that computer-mediated learning communities can play a positive role in helping teachers, students and families find the educational resources that will help them cope with the new demands. But it will be necessary to take measures to train far more teachers in the use and access to on-line learning resources. It will also be necessary to find creative solutions to the problems of family access.

4. Some conclusions based on the authors' experience

Over seven years of Project TELL, we created an on-line learning community which often became extremely compelling for student and adult participants alike. There is no doubt that in the future, it should be possible for dedicated educators and students to develop even larger and more diverse communities like that of Project TELL. Here we are not talking merely about chat rooms or Web pages, but highly interactive and structured situations where adults and students participate in on-line learning activities, including writing projects, science projects, discussion groups, counselling sessions and peer tutoring encounters. In such a learning environment, there can be almost revolutionary gains made by students who would otherwise be destined to become school failures and underachievers. There is enormous potential in these on-line learning communities for peer tutoring and collaborative projects in which learning is a multi-dimensional process rather than a one-way,

conventional teacher-to-student drilling of skills and practice. Project TELL demonstrates that special efforts, which include the active participation of university faculty and students, must be made to involve disenfranchised children in these exciting learning communities. They and their families can add a great deal to the learning environment because they have unique strengths to offer. Their educational needs receive most of the attention, but their presence on line adds a great deal of excitement and depth of human experience to on-line learning. We fear, however, that unless many more efforts like Project TELL are encouraged, the gap between the technological haves and the have-nots will only continue to widen. We are doubly proud, therefore, to be among the first to offer hard proof that this need not be an inevitable outcome of the information age.

REFERENCES

- Braman, Sandra. "Information and socioeconomic class in U.S. constitutional law". In: *Journal of Communication* 39, No. 3 (Summer 1989), 163-179.
- Brunet, Jean and Serge Proulx. "Formal versus grass roots training: women, work, and computers". In: *Journal of Communication*, 39, No. 3 (Summer 1989), 77-84.
- Castells, Manuel. 1996. *The Rise of the Network Society*. Cambridge, MA: Blackwell Publishers.
- Cummings, Scott B. and Theodore Koebel, eds. 1992. *Journal of Urban Affairs*. Vol. 14, Greenwich, Ct; IAI Press.
- Downing, John D.H. "Computers for political change: peacenet and public data access". In: *Journal of Communication*, 39, No. 3 (Summer 1989), 154-162.
- Houk, R. 1997. *Transitions: the family and the school in historical perspective*. Orlando: Academic Press.
- Kantrowitz, Barbara. "The information gap: computers deepen gap between rich and poor." In: *Newsweek*, (21 March 1994), 78.
- Kerr, Stephen T., (ed.). 1996. *Technology and the future of schooling*. Chicago: University of Chicago Press.
- Kornblum, William and Terry Williams. 1994. *The Uptown Kids: Struggle and Hope in the Projects*. New York: Putnam.
- Krendl, Kathy A.; Mary C. Broihier and Cynthia Fleetwood. "Children and computers: do sex-related differences persist?" In: *Journal of Communication*, 39, No. 3 (Summer 1989), 85-93.
- LaRose, Robert and Jennifer Mettler. "Who uses information technologies in rural America?" In: *Journal of Communication*, 39, No. 3 (Summer 1989), 48-60.
- Murdock, Graham and Peter Golding. "Information poverty and political inequality: citizenship in the age of privatized communications." In: *Journal of Communication*, 39, No. 3 (Summer 1989), 180-195.

- National Council on Disability (U.S.). 1996. *Access to the information superhighway and emerging information technologies by people with disabilities*. Washington, DC: National Council on Disability.
- Natriello, Gary; Edward L. McDill and Aaron M. Pallas. 1990. *Schooling disadvantaged children: racing against catastrophe*. New York: Teachers College Press.
- Oppenheimer, Todd. "The computer delusion". In: *Atlantic Monthly*, (July 1997), 45-48.
- Papert, Seymour. "Use computers to spark kids' curiosity about the world". In: *UTNE Reader*, January-February 1994, 92-4.
- Ribich, Thomas I. 1968. *Education and poverty*. Washington, DC, The Brookings Institution.
- Rubinyi, Robert. "Computers and community: the organizational impact". In: *Journal of Communication*, 39, No.3 (Summer 1989), 110-23.
- Scherer, Clifford W. "The videocassette recorder and information inequity". In: *Journal of Communication*, 39, No. 3 (Summer 1989), 94-103.
- Skinner, David. "Computers: good for education?" In: *The Public Interest*, 128 (Summer 1997), 98-109.
- Siefert, Marsha, George Gerbner and Janice Fisher, (eds.). *Journal of Communication*, 39, No. 3 (Summer 1989).
- Stafford, L. and Harris, Rey O. 1996. *The African American resource guide to the internet and on-line services*. New York: McGraw-Hill.
- Stoll, Clifford. 1996. *Silicon snake oil: second thoughts on the information highway*. New York: Anchor Books, Doubleday.
- Tiffin, John and Lalita Rajasingham. 1995. *In search of the virtual class: education in an information society*. New York: Routledge.
- Winner, Langdon. "Computers and hope in an urban ark". In: *Technology Review*, 100, (May/June 1997).

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