

NETWORKS FOR LEARNING RENEWAL
THE CENTER FOR COLLABORATIVE EDUCATION
and
INSTITUTE FOR LEARNING TECHNOLOGIES
COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK

The Eiffel Project

New York City's Small Schools Partnership Technology Learning Challenge

Version 1.2
September 1996

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Project Abstract

A consortium - led by the Center for Collaborative Education (CCE) and the Institute for Learning Technologies (ILT) at Columbia University - joins through the New York City Board of Education to demonstrate how children contending with poverty, discrimination, and urban crowding can achieve world-class education standards when liberated by fundamental efforts at school reform, empowered by the full use of advanced digital information.

In its fifth year, the Eiffel Project will directly benefit at least 67 schools, engaging 30,000 students, most from African-American, Latino, immigrant, and economically disadvantaged families, with 1,350 teachers. The project will further serve numerous parents and community members accessing it through 10 community-based organizations in areas where the need for technology is acute.

1. **Vision for Improved Education:** As the Eiffel Tower showed the world a century ago how architects could use new materials to break existing architectural constraints, now digital technologies loosen long-lasting constraints on education, constraints which have shackled many with limiting opportunities. Digital technologies are for education what iron and steel, reinforced concrete, plate glass, elevators, and air conditioning were for architecture. The Eiffel Project will show how the small schools reform movement, empowered with advanced media, can break the constraints of the traditional school, thereby enabling all children to achieve unprecedented levels of excellence.
2. **Convergence with the Small Schools Reform Effort.** New York's school reform movement has support from the Annenberg Foundation; the Mayor, City Council, and Board of Education; the State Board of Regents; the teachers' unions; key universities; and major civic and corporate partners. All recognize that large schools have too often been alienating institutions, mediocre as places of education and most effective in keeping kids off the streets. The small schools reform movement is transforming big, impersonal schools into smaller, autonomous learning communities, scaled to nurture the child, to provide face-to-face meaning for both students and teachers. The Center for Collaborative Education has been a leader of this movement since its inception, in New York City and in the nation at large.
3. **Uses of Technology.** Digital libraries, multimedia educational programs, and

wide-area networking make advanced media a powerful engine for equity. The digital library and digital museum bring an unprecedented wealth of resources to the desktop in school and home. Educational experiences, activated by multimedia simulations, appeal to many learning styles, engrossing students of all backgrounds in cooperative, inquiry-based study. Wide-area networking ends classroom isolation through desktop video conferencing and group work in a content-rich context. All these media make digital portfolios effective educational tools. For the past decade, the Institute for Learning Technologies has prototyped progressive uses of these technologies in urban schools.

4. Evidence of Effectiveness. School reform and technology strategies for the Eiffel Project have been developed and tested by CCE, ILT, and their collaborators through prior projects. CCE has pioneered use of portfolios and exhibitions of student work as a means of assessment and a key graduation requirement for students. Through the Dalton Technology Plan, the Living Schoolbook Project, and the Harlem Environmental Access Project, ILT has introduced advanced media in diverse urban schools.
5. Consortium Membership and Contributions. In addition to the conveners, CCE and ILT, over twenty organizations participate in the consortium. Key corporations (Kodak, NYNEX, Time-Warner) will provide resources to develop technology-based portfolios, high-bandwidth networks, advanced media centers, and digital libraries. Centers and Institutes from diverse components of Columbia University and other organizations such as Junior Achievement will provide mentoring, expertise, and intellectual content to enhance this effort; specialists from NCREST, NYU, and Teachers College will evaluate it. Large community development projects such as the Upper Manhattan Empowerment Zone and smaller ones such as the Harlem Parents Tutorial Project will help link school reform to homes and communities.

The Challenge Grant for Technology in Education provides funding of \$7 million over five years, with \$11 million required from consortium partners in order to meet the project challenge. The consortium seeks to double those goals through additional fund-raising, and to extend the project at least five years further into the 21st Century, in order to have transformative effects on educational achievement in New York City and the region.

The Eiffel Project New York City's Small Schools Partnership Technology Learning Challenge

In the 1889 Paris World's Fair, the Eiffel Tower rose far above the scale of any existing building, demonstrating to the world how engineering design, working with new materials and techniques, could break prior constraints on architecture. Digital information technologies are for education what iron and steel girders,

reinforced concrete, plate glass, elevators, central heating and air conditioning have been for architecture. Digital technologies break significant, long-lasting constraints on educational activity, constraints that have suited too few and shackled many with limiting opportunities.

The objective of the Eiffel Project is to meet progressive expectations with a high profile, large scale project that will demonstrate that the small schools reform movement, empowered with advanced media, can break the constraints of the traditional school, thereby enabling all children to achieve unprecedented levels of excellence.

1) The Challenge: Offer a Creative New Vision for Technology in Education

A consortium -- led by the Center for Collaborative Education (CCE) and the Institute for Learning Technologies (ILT) at Columbia University -- will join in a large scale demonstration of how children contending with poverty, discrimination, and urban crowding can achieve world-class education standards when liberated by fundamental efforts at school reform, empowered by the full use of advanced digital information. The Eiffel Project will bring the intellectual, cultural, and human resources of a major research university, one committed to improving the quality of life in New York City, to bear on the complex problems of urban education.

A depressed urban semi-circle -- Harlem and Upper Manhattan, the South Bronx, Queens, downtown Brooklyn -- experience the persistent problems of inner cities in America. These communities surround the commercial core of Manhattan, which harbors an immense wealth of cultural, technological, and financial assets. The objective of our coalition is to show that the combination of school reform and technological resources can solve the persistent problems of education associated with urban adversity.

Marshall McLuhan's suggestive phrase, "the medium is the message," is most apt in thinking about schools. Large, bureaucratic schools that treat students and teachers as depersonalized, interchangeable agents who perform routine, fragmentary tasks along the production lines of instructional labor, impart the wrong message. To advance equity and excellence, educators must reshape the school itself, so that it conveys a more expansive, liberating message. This conviction grounds the small schools reform movement, which seeks to scale down the size of schools, to make them more autonomous and self-directing, to concentrate on what teachers, parents, and children find important and moving.

In New York City, a school-reform movement has taken root, with support from the Annenberg Foundation; the Mayor, City Council, and Board of Education; the State Board of Regents; the teachers' unions; key universities; and major civic and corporate partners. Large schools serving the urban poor have too often been

examples of the school as factory and warehouse -- big, impersonal institutions, mediocre as places of education and most effective in keeping kids off the streets. The small schools reform movement seeks to transform big, impersonal schools into models of autonomous learning communities, scaled to nurture the child, to provide face-to-face involvement for both students and teachers. The Center for Collaborative Education has been a leader of this movement since its inception, in both New York City and the nation at large.

The Center for Collaborative Education gives the Eiffel Project a firm base in the small schools reform movement. The project will work to extend and strengthen this base, stressing smaller class sizes, cooperative learning, interdisciplinary study, and strong parent and community involvement. In 1987, the NYC Board of Education agreed to support the work of CCE, which provides on-going leadership to a growing number of schools that are restructuring on the model Deborah Meier created through the renowned Central Park East Schools. In 1995, the Annenberg Foundation awarded a "Networks for Learning Renewal" grant to four groups pioneering small schools reform in New York City -- CCE, the Manhattan Institute, ACORN, and the Fund for New York City Public Education. As part of the Eiffel Project, CCE is developing an association of restructured public schools across the City -- the Small Schools Partnerships, clusters of three to five schools within one or more community school districts. By 2001, CCE will directly support restructured educational and governance practices among 13 Small Schools Partnerships in all five of the City's boroughs, serving 22,000 students and 1,000 teachers.

Building on the Small Schools Partnerships, the Eiffel Project will additionally develop a second ring of schools that are restructuring according to the same fundamental principles but are not receiving direct Annenberg support through CCE. Some receive support through other Annenberg grantees, particularly the Fund for New York City Public Education, a consortium partner in the Eiffel Project. Several will be schools reshaping on small schools reform principles through projects that ILT has initiated such as the Living Schoolbook, the Harlem Environmental Access Project, and Reinventing Libraries. A few will be Schools under Registration Review that seek to reverse cycles of school failure by changing scale and using advanced technology. In all, in its fifth year the Eiffel Project will directly benefit at least 67 schools, engaging 30,000 students, most from African-American, Latino, immigrant, and economically disadvantaged families, with 1,350 teachers. The project will further serve numerous parents and community members accessing it through 10 community-based organizations in areas where the need for technology is acute.

Throughout the Eiffel Project, the key criteria for inclusion are the willingness of teachers at each school to take responsibility for shaping the curriculum and educational program and the commitment of all involved -- students, teachers, administrators, and parents -- to working at a scale at which interpersonal, face-to-face recognition of each other as autonomous agents, responsible for their actions, is the controlling norm. Technology can greatly facilitate such efforts.

Digital libraries, multimedia educational programs, and wide-area networking -- three related and maturing technologies -- make advanced media a powerful engine for equity. These technologies have great educational significance, and the Institute for Learning Technologies has been a leader in their use and development. The libraries of the very richest schools represent minor academic resources compared to those of the digital library and digital museum, which become accessible at the desktop in school or home with appropriate connections to the Internet.

Educational experiences, activated by multimedia simulations, can appeal to diverse learning styles and engage students of all backgrounds in cooperative, inquiry-based educational work. Wide-area networking can enable desktop video conferencing and group work in a content-rich context, and these new forms of educative communication can overcome the traditional isolation of the classroom, bringing youthful minds actively into the laboratory, the archive, the field station, the theater, the museum, and the office. With these technologies fully deployed, all students can attain an unprecedented improvement in educational quality.

Implicit in their chosen scale, small schools encounter significant limits, particularly in large cities. Urban schools, large or small, must cope with significant diversity among students. In CCE's Brooklyn New School, students speak 36 different languages. Throughout the City, students draw on disparate experiences and aspire to diverse visions. Small schools must cope creatively with complexity, and consequently networking -- interpersonal and technological -- has become essential in the school reform movement. Networks of and for small schools can provide deep and diverse resources to suit the remarkable range of human difference. The Small Schools Partnership is developing these sustaining interpersonal networks, and Columbia University will augment these with digital information networks adapted specially to serve small school reform. The interconnection of school-based personnel will also be supported by Media Centers, discussed at length in section 3b. These will exist as nodes on the electronic network and will form the connective tissue between school-based activities, community involvement, and overarching systemic management.

In pursuit of better possibilities, it is time to move from isolated pilot projects, which merely suggest the potential of new technologies, to implementing a large, decisive demonstration of their power. We believe the cost-benefit equation to be achieved with thorough use of advanced media in education, particularly in support of the school reform movement, will be advantageous for the whole society, but it will be a difficult equation to demonstrate in the arena of public discourse. The reason is simple: the benefits of small schools strengthened with advanced media will be very, very great relative to the current state of schooling, yet those benefits can be realized only by a significant reordering of expenditures on education. Can we persuade the public and its leadership to make a significant reallocation of resources? Evaluation studies of pilot programs -- showing incremental gains in a traditional subject in one or another grade -- will not suffice to make the needed point in policy debate. A sustained, dramatic, large-scale, decisive demonstration, concentrated in a prominent locality that embodies the recalcitrant difficulties of

contemporary life, can infuse the policy debate with new vision. The City of New York is the place to produce that demonstration -- the Eiffel Project.

2) The Response: A Digital Pedagogy for New Learning Communities¹

By itself, technology is a limp educational resource. To benefit complex persons and communities, effective educational ideas and actions must inform use of information technology. The Eiffel Project seeks to infuse technology with powerful pedagogical ideas, and to empower those ideas with the force of technical innovation. We explain our pedagogy in two sections. First, in "The School and the Child," we present our convictions about how the reform of schools combined with the astute use of technology can liberate the child to learn more effectively, more deeply, more meaningfully. Then, in "The School and Society," we examine how the reformed school opened to the world through digital networks will help children be more effective and sure as they encounter the complexities of public life, the workplace, and the culture.

2a) The School and the Child

To achieve its educational objectives, the Eiffel Project needs to make them real in the educational experience of participating students and teachers. Our mission is the radical improvement of educational experience for thousands of students and teachers, and as they model new educational possibilities, for millions more. Education is the end; reformed schools and new technologies are the means.

In this section we discuss four established educational elements - libraries, experts, project-based learning, and portfolios. Significant change is possible because information technology strengthens their educational power. Technologically transformed, these all loosen the intellectual constraints operating in the school and thereby expand the educational potentialities of the child.

2a1) Use Digital Libraries to Enhance Learning

Digital libraries -- the distributed, on-line collection of texts, images, sound, video, simulations, and data, along with powerful tools for using them -- radically reduce constraints on cultural and intellectual participation that traditionally operate in educational institutions. Columbia University is drawing out the implications of digital libraries for the advancement of learning through design initiatives by the Center for Research on Information Access, the Center for New Media, and the Center for Image Technology for New Media, and through implementation projects in art history, history, chemistry, earth sciences, journalism, and so on. Within this overall effort, the Institute for Learning Technologies (ILT) directs application of work on digital libraries to the reform of K-12 education.

Digital libraries can significantly loosen the constraints that have historically determined the spectrum of possible educational achievement by the young. Digital libraries are a key, emerging agency that makes feasible the basic aim of enabling students growing up under conditions of adversity to attain unprecedented levels of excellence. Whether modeling El Niño effects with data from the Lamont-Doherty Earth Observatory, researching Renaissance portraiture with the Columbia Art Humanities digital image archive, or comparing Orson Welles' and Roman Polanski's interpretations of Macbeth using a multimedia database constructed by the New Lab for Teaching and Learning, students can be engaged in serious disciplinary study when they have access to digital libraries. To enable students and teachers to make full use of digital libraries in their daily educational work, we will concentrate on four tasks:

- **Infrastructure.** Extend local area networks into classrooms and link these to the world's information infrastructure by very high-speed connections, permitting small groups of students to work collaboratively to employ digital libraries in responding to significant questions and difficult problems.
 - **Content.** Work with scholars, practitioners, teachers, and community leaders to develop comprehensive and specialized collections; tools of analysis, synthesis, and simulation; and strategies of engagement to make the digital library a routinely accessible and easily usable resource in the educational work of students and teachers.
 - **Support.** Provide schools and teachers with effective professional development experiences that will enable them to adapt to the emerging pedagogical possibilities and provide students with tools to consult hierarchies of on-line expertise that will sustain an inquiry-driven learning process.
 - **Evaluation.** Engage in the continuous formative evaluation of such efforts in order to assemble a record of practical experience, which can then lead through progressive reflection to improved practices and an understanding of guiding principles.
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2a2) Interact with Mentors and Experts at a Distance

One-on-one adult mentoring is tremendously effective in helping young people cope with the complications of integrating all the disparate elements of human development. Wide-area networking can greatly lower the cost in money and time that such mentoring entails. Multimedia, wide-area networks, and desk-top videoconferencing will likewise enable problem-solving groups in schools and communities to interact with diverse strata of experts, who can help the groups advance their efforts. The Eiffel Project will work to design and implement ways to use digital technologies to enable working groups of students to interact, frequently and easily, with mentors and experts.

To make interactions between students, mentors, and experts sustainable and

effective, it is important to recognize and respect the constraints inherent in adult responsibilities. Mentors and experts cannot ignore imperatives of their own work to take up the concerns of children. Rather, the educational work must synchronize with their professional efforts or it will become a complicating, distracting chore. The Eiffel Project will work with both the business community and the academic community to design ways to enable their members to work educationally as mentors and experts while minimally deflecting them from their primary goals.

Junior Achievement of New York City, a strong chapter of a national effort by business people to provide volunteers to teach children at all levels about the economics of work and life, will join in the Eiffel Project to use advanced media to facilitate their mentoring work. Currently, Junior Achievement volunteers go to a school to teach specially designed courses and to provide counsel and advice. This procedure has limits arising from the constraints on the volunteer's time and it leaves the student at a distance from the world of practice that the volunteer represents. As schools become wired, so do businesses, and it becomes possible for the students to gain virtual access to the operations of the work world, with volunteers from it acting, not as emissaries, but as hosts. Junior Achievement will work through the Eiffel Project to implement these possibilities as an important means of strengthening the understanding of economic life that children in participating schools develop and as a productive way to improve the school-to-work transition.

Small groups of students, working to solve difficult problems, often need to discuss their ideas with people who have greater expertise than they, or their teachers, may have. Wisdom and skill are scarce qualities, however, and eminent scholars would be overwhelmed were every curious novice to take his questions directly to the highest possible authority. Through the Eiffel Project, we will use distance learning technologies to create a relationship between schools and universities that enhances educational processes in each domain without deflecting people in either from their proper concerns. Students will develop the capacity to judge when someone else has satisfactorily helped to clarify their questions. If responses to queries have been sufficient, students should go on to other matters, and if they have not, they should push on with their inquiries, seeking other, more productive interlocutors. On the university side, responding to school-based queries can become an important enhancement to learning in higher education. Consider the academic cliché that someone never learns anything so well as when he must teach it. Undergraduates will advance their study of a subject by helping children in schools answer difficult questions, interacting with them through distributed learning technologies. Queries that the undergraduates find too difficult to help with, they can refer to graduate students, and from there, if necessary, to research scholars, professors, and other professionals. A team from the Institute for Learning Technologies and the Center for Imaging Technologies for New Media has developed a prototype desktop videoconferencing system by which universities can announce the availability of respondents, and students in schools can initiate exchanges as suits their inquiries. As part of the Eiffel Project, we will develop the prototype into a working system

and test it in key subject areas.

2a3) Synthesize Knowledge through Project-Based Problem Solving

As it exists, the school separates the fabric of learning into discrete strands according to grade, subject, period, and lesson, and the curriculum converts powerful intellectual means into the operative ends of educational work -- e.g., whereas the historian uses chronology, the high-schooler learns it. Advanced media in education permit the reintegration of intellectual activity in the school, as students use powerful on-line tools and work with the contents of the digital library to pursue answers to the questions and issues that animate scholarship, science, and professional practice. How can a major research university, collaborating with diverse schools, shift the process of curriculum development away from packaging prescribed epitomes of answers to be learned by cohorts of pupils toward a process of selecting and putting powerful questions worth engaging all students in the effort to answer them?

A successful response to this question must meet key constraints - 1) development costs need to be limited; 2) a unified set of changes affecting the educational process from beginning to end needs to be introduced; 3) changes need to be on one side radical and thorough, yet on the other relatively well-aligned with existing practices; and 4) educational results need to be dramatically better than those of the status quo ante. The Eiffel Project, through its relationship to Columbia University, will use advanced media to develop a pedagogy of project-based problem solving designed to meet these constraints. This effort will build on a range of prior work by the New Laboratory for Teaching and Learning at the Dalton School developing powerful curricular prototypes such as Archaeotype, at the Ralph Bunche School with Internet-based inquiries such as The Great Penny Toss, and through ILT's Harlem Environmental Access Project.

Basically, the new curricula will have three components -- questions or problems requiring solution, tools or intellectual strategies for working on the problems, and resources or data and materials upon which the tools can operate. The first task of curriculum design is to lay out highly generative sets of questions, put forward without answers, which students can address at one or another level of sophistication:

- FAQs, or Frequently Asked Questions, pronounced "facts." For any subject there are many FAQs, which can be organized according to difficulty and scope. A FAQ requires a clear, informative response. In educational experience, it is useful to work up answers to many FAQs, developing in the process a clear overview of a subject.
- HAQs, or Hotly Argued Questions, pronounced "hacks." HAQs generally elicit more heat than light, and the challenge to the student is to understand why the question so provokes the passions. In educational experience, a HAQ should elicit a clear presentation of all sides of the argument, with a

- dispassionate weighing of the strengths and weaknesses on each side. Such treatment of a HAQ will develop perspective and intellectual independence.
- LUQs, or Largely Unanswered Questions, pronounced "lucks." The object in engaging with a LUQ is not to try heroically to answer it, but to ascertain what aspects of it are subject to comprehension and to be able to explain why the question remains largely unanswered. In educational experience, a LUQ leads the student to reflect on the limits of knowledge and to set his sights on extending it.
 - PIQs, or Profoundly Important Questions, pronounced "picks." With a PIQ, the key is to grasp the importance of the question and to feel the urgency of developing a response to it, as well as the import of that response. In educational experience, a student comes to realize that a PIQ can affect the fundamental prospects of life, personal or collective, as operative answers to PIQs contribute to defining what it means to live and to be human.

Tools and resources gain meaning in relation to such sets of questions because tools and resources are what a problem-solving student employs in seeking to respond productively to questions that have been effectively posed. On-line tools and resources suit a problem-solving pedagogy because they are comprehensive and unbounded, sustaining the questioning process without extrinsic limitations. We believe that academic groups can be very helpful curricular resources for students and teachers in schools by identifying key sets of questions, building powerful tools with which students can address those questions, and opening paths to significant resources, grist for the educative mill of inquiry.

Initially, scholars from Columbia's African Institute, researchers from classics, history, and archaeology, and scientists from the Black Rock Forest Consortium, Biosphere II, and the Lamont-Doherty Earth Observatory will work with students and teachers in the Eiffel Project to develop and test this model of problem-solving curriculum development. It allows for high-level academic involvement in the process while keeping operative control of inquiry and learning in the hands of teachers and students at the school level. Each year, academics will lay out a distinctive set of questions for their respective fields and they will work to provide a growing repertoire of tools and resources useful in pursuing generative questions from each field. But organizing and putting questions so that collaborative groups embark on a course of problem solving, and activating and using the tools and resources, will remain the work of teachers and students, done distinctively in each school. We envision the University annually publicizing its technology learning challenges across a variety of fields, posting sets of FAQs, HAQs, LUQs and PIQs, along with continually developing sets of smart tools and intellectual resources linked to them. Collaborative groups of students, with teachers on site and mentors and experts at a distance, would use the on-line system of tools and resources to develop their unique responses to these learning challenges, posting them to the world on their local websites. As the Eiffel Project proceeds, we will extend this pedagogy across all the areas of learning as quickly as resources permit. We believe that such a pedagogy can meet the four key constraints indicated above and

lead to the radical restructuring of the curriculum in ways that will be highly conducive to effective learning by all students.

2a4) Integrate Educational Experience through Portfolios

Portfolios are an educational resource that can enable students to tie together all the lines of experience indicated in previous sections, using networked multimedia tools to create a public persona that expresses the cumulative character of their studies, achievements, and interests. In Coalition schools, the portfolio constitutes a representation of a student's total academic experience, either within one course or across many. It assembles academic work that exhibits the student's development through his studies. As for the professional, so for the student: a portfolio presents cumulative accomplishment through assembled work. As such, the portfolio -- along with the accompanying exhibitions or performances -- stands as documentation of where the student has been and what the student has done through reflective action.

A networked, multimedia information environment extends and reconfigures the portfolio as a curriculum tool in three important ways:

First, as the student works in more diverse media, the palette of tools with which he may engage his subjects broadens. In the print-based school, most activity is limited to reading and writing textual material; in a digital school, students work with image, audio, video, and text more freely and continuously. They learn the "grammar" of video and audio editing, just as they always have the grammar of text. Two key partners, the Educational Video Center, which has pioneered use of video production as a means of education, and the Institute for Learning Technologies, which has done the same using web-site production as an educative tool, will join to integrate these techniques into the project's portfolio designs.

Second, as the student works in a networked information environment, he can extend the audience for his portfolio as widely as the student or his teachers desire. The networked school thus connects two fundamental concepts in the small schools effort -- portfolio and exhibition. Exhibition ceases to be set apart and becomes inherent in the portfolio, through which students and teachers can engage each other's work. Work can be shared asynchronously; students can make their work accessible, allowing others in the virtual community to comment, advise, respond at their convenience. In a sense, work is always on exhibit except where workers feel it is not ready for public view.

Third, as the student works through the inherent web-like structure of a hypermedia "document," the portfolio ceases to be an assemblage of finished works. The virtual portfolio becomes a dynamic combination of refined, polished works with works-in-progress, notes, annotations, and even passing thoughts. In this sense, the hypermedia portfolio is a fuller realization of the basic notion of the portfolio because it easily allows the student to document all his thinking, and it allows the

student to keep active the total corpus of his academic and other intellectual experiences and acquisitions throughout his academic career as the portfolio is built over time.

In the context of the Eiffel Project, the portfolio will be a central structure, used in novel ways that build on past successes. One of the participating Partnership schools -- the Central Park East Secondary School (CPESS) -- has been at the forefront of graduation by portfolio for many years. In June 1996, CPESS graduated its sixth high school class by performance-based assessment. Students must prepare and defend 14 different portfolios of material to graduate. We will build on this experience with portfolio assessment in order to use it in new ways in new schools.

For instance, in addition to dissemination of project work within the network of project collaborators, students, teachers, and schools can begin to disseminate their portfolios and share their knowledge and ideas on a national, and even a global, scale. Working with Eastman Kodak Company, our consortium will use digital imaging to experiment with the documentation of multimedia portfolios in CD-ROM format. Since few members of the larger educational community enjoy the broadband network connectivity that makes high-speed multimedia networking feasible, CDs represent a simple, and increasingly inexpensive, means for teachers and students to exhibit their work. Of course, students will mount this work on the Web, as well, to promote easy use by those with adequate connections.

Portfolios and exhibitions not only enable students to integrate their educational experience: they equally enable the Eiffel Project itself to integrate its pedagogical accomplishments and present them to the general public. The portfolio process can play an integral role in teachers' professional development and in program dissemination as well. As CPESS students can represent their work in multimedia portfolios, so too can their teachers. Through such documentation, parents and the public can assess, critique, exhibit, and acclaim teachers' work. Thus the teacher portfolio is a professional development, a dissemination, and an accountability mechanism all in one. Whole schools can use the multimedia portfolio in similar ways to exhibit their innovations and disseminate successful programs and projects.

Such online resources will enable the Eiffel Project to engage parents more productively. For instance, through a carefully placed network of off-site nodes, available at hours outside the typical 9:00 to 3:00 school day, parents will be able to access teachers and school web-sites and portfolios, enhancing their role as stakeholders in the education of their children. As we add schools, so will we add such community service providers, for instance, the Harlem Parents Tutorial Project, with a 25-year history of parent training, as key in administering off-site parent access to the network and the adult involvement in the education of their children that the network provides.

Educational accountability remains an intractable public problem largely because the work and fruits of education are hidden from view behind classroom walls.

What the Eiffel Project enables students and teachers to accomplish with respect to each of its pedagogical objectives will be visible to anyone who cares to look. How students and teachers work as educators -- how they develop the small schools ethos, use digital libraries, collaborate in learning, interact with mentors and experts, synthesize knowledge while solving problems, engage in civic issues, seize workplace opportunities, create cultural meanings from multiple traditions, and integrate it all into expressions of unique personhood -- will be public knowledge, evident through the portfolios of project participants. The school and the child leads through emerging networks to an entirely new relation between the school and society, one that opens innumerable opportunities, enabling children to develop their capacities to the fullest possible extent.

2b) The School and Society

Conditions of social, economic, and cultural life deeply affect educational work, and the Eiffel Project must not ignore these realities. Educational initiatives alone cannot solve social, economic, and cultural problems, even though these problems often lead educational initiatives to fail. A powerful pedagogy must go beyond the school, beyond the educational process in the narrow sense, to work in concert with broader civic, economic, and cultural initiatives. Education cannot solve social problems, but a community that acts in concert to overcome its difficulties presents children with a deeply educative context and a resonance can build between enlightened educative effort and visionary social action.

In search of such resonance, the Eiffel Project will work closely with the Upper Manhattan Empowerment Zone (UMEZ), and in our scaling up efforts additionally with the Kingston-Newburgh Enterprise Zone (see Section 5). Technologies that can empower school reform can also enable more integral, effective social action. Networking technologies will enable people who live under difficult circumstances and face complex, many-sided problems to link in their everyday perception challenges and resources that they now encounter as seemingly separate sectors of activity -- schooling, employment, health, housing, safety, and the environment. A powerful pedagogy should empower people to see action in one sector as an action contributing to the whole ensemble, which in its complexity determines the quality of life.

2b1) The School and the Home

We have four basic strategies for extending new pedagogical resources to children in inner-city homes and communities: educating parents to help them understand the new pedagogical resources; making technology resources in school available to parents and community members after school, weekends, and during summers; providing access to those resources through community-based organizations; and helping economically disadvantaged families acquire advanced technologies in

their homes. Here are examples of ways in which consortium members have initiated distinct efforts to implement these strategies. We will expand and add to these beginnings as the project develops.

- Innovating schools need to make special efforts to help the parents of their students understand their pedagogical efforts. This is particularly true in inner-city settings where parents often have difficulty getting access to educational information. The CCE Schools have pioneered regular, pro-active efforts to educate parents about the schools' educational principles. Such cultivation of parental understanding and involvement is becoming standard in NYC's small schools movement. It will be the foundation for work extending the Eiffel Project's benefits to homes and communities.
- An important mission of the Media Centers in Eiffel Project schools is to afford parents and community members a fuller understanding of the educational principles of the effort. These centers will host regular meetings with parents, showing them how their children are using technology to augment their educational opportunities. In addition, the Media Centers will provide parents opportunities to use these resources in work preparedness programs, for many parents need to upgrade their skills to succeed in an employment market that is increasingly knowledge-based.
- In Columbia's Harlem Environmental Access Project (HEAP), a building block of the Eiffel Project, the Countee Cullen branch of the New York Public Library has been equipped, along with participating schools, to afford children, parents, and the community access to HEAP outside school facilities and hours. Likewise, CCE is collaborating with branch libraries in the South Bronx and East Harlem to develop programs for parents of children in its schools and will deal with technology-based pedagogies along with other educational matters in these.
- In mid-August, a community-based partner in Eiffel, the Harlem Tutorial and Referral Project, submitted a proposal to the Corporation for Public Broadcasting for "Project P.A.R.E.N.T. - Parents Accessing Resources by Engaging New Technologies." This project, developed with ILT, seeks \$81,000 from CPB and will roughly match it in kind. As the project proposal states, "In an area with some of the lowest educational performance levels anywhere in the country, this project will offer new technological resources to parents as a means of redressing their inability to gain vital information, and hence become constructively involved in the education of their children."
- The Lander Street Project in Newburgh is a direct effort to extend new pedagogical resources and communications technologies into the homes of children in low-income families. Housing units in the Lander Street Project will be wired (ethernet), equipped with networked computers, and connected to the servers of the Newburgh Enlarged City School District nearby, which will in turn have Internet access through the Columbia system via a T1

connection. The Eiffel Project will provide Lander Street tenants training and support in using the home-based technologies and it will evaluate whether these resources help children in these families benefit from expanded educational opportunities. This effort seeks to build a case for making advanced technologies integral components of 21st century low-income housing projects. We are working to arrange for a similar New York City trial, currently at a Harlem site on 116th Street.

- High on the Eiffel Project agenda for implementation in collaboration with the Upper Manhattan Empowerment Zone is a program permitting families to acquire home computers at very low-cost through used-equipment donations. Already, the Ralph Bunche School is maintaining a small dial-in modem pool, connecting home-based users to its servers and the Internet. Preliminary experience here has uncovered hidden costs in such plans: the combination of old equipment and unskilled, novice users leads to substantial support problems. Before embarking on a large donation program, we want to make sure that they are not less cost effective than they appear to be on the surface.

In addition to such ground-up efforts to provide families and communities access to advanced media in education, it is important to address key structural issues that affect how well people can benefit from improving educational resources. The discussion below, under 2b3) Achieve Productive Potential in the Workplace, is integral to extending new pedagogical resources to children's homes, as it is essential in motivating effort for everyone, including students and their families, to address the long-term secular shift in the New York Metropolitan Region from an economy offering good industrial jobs to one in which manual labor is shrinking steadily while high-skilled, knowledge-based employment is growing.

2b2) Engage in the Civic Concerns of Public Life

Through the project, students in schools should be able to engage with representatives of their communities, to work on health, environmental, and social issues, to develop habits of service and involvement, and to form a sense that they face significant choices and that they command significant resources with which to put their choices into action. It is particularly important that children growing up under difficult circumstances learn to engage in the effort to take control of those circumstances, to experience life as a series of challenges to which people can respond purposefully. Through the Eiffel Project we intend to seek out diverse opportunities to use information technologies to engage children in thinking and acting on real civic concerns. In this project, we will work with the UMEZ and other groups seeking to effect long-term social change and human betterment in health, housing, employment, safety, and environment, to apprise children of serious issues and to engage their participation in deliberation and action. We have piloted these practices through ILT's Harlem Environmental Access Project by using wide-area communications to encourage students to recognize the breadth

and diversity of concern for the environment. For instance, using data provided by the Environmental Defense Fund, students investigate the effects of different solid waste management systems. Just as the technology supports their research efforts, so it supports their reporting. Through web-mounted hypermedia presentations, students offer their findings to the world at large, staking out well-documented policy positions they can link to those of professionals. Thus, they use the technology to address the public about what is to be done, to model effective initiatives for it, and to engage in the give and take of trying to persuade people with power to act in different ways. These are invaluable lessons for anyone to learn about the relation of thought and action.

Also in Harlem, Eiffel is developing collaborations with a number of Community-Based Organizations (CBOs) in order to support their technology-based programs. For instance, a planned technology-based skills-development program sponsored by the New York City Chapter of 100 Black Men and the Church of the Master will link with the extensive technology facilities nearby in the Ralph Bunche School. Extending school technology facilities to CBO's after normal hours can effectively make sophisticated technologies available to people who cannot afford to acquire them for their homes. So too can developing project technology facilities directly in CBO's. ILT is collaborating with the Harlem Center for Digital Technology to help provide connectivity, curricular resources, and training opportunities for their Digital Apprenticeship Program, which "addresses the issue of technological equity by providing poor youth with a structured process to earn while acquiring digital competencies, character development and work preparedness" during summer and after school and on Saturdays.

2b3) Achieve Productive Potential in the Workplace

If the information economy exists anywhere, it is the economy of the New York-New Jersey-Connecticut Metropolitan Area. The Eiffel Project should deploy information technology in the schools with, for, and through the diverse employers in the region who constitute that information economy in communications, media, publishing, banks, universities, medicine, and government. The Eiffel Project will use high-speed digital telecommunications to build continuous, powerful connections between participating schools and the information economy of the City, region, and world, and its volunteers from Junior Achievement and elsewhere will work with students and employers to ensure that these connections provide learning opportunities and apprenticeships that will enable students to achieve their full potential within the information workplace.

This use of technology is crucial. Several generations of inner-city students have learned to distrust large, bureaucratic schools, experiencing them not as stepping stones to self-advancement, but as source and legitimization of their frustrations, limits, and stigmata. Small school reform is important in helping the disadvantaged

regain some conviction that schools present them with significant opportunities because they encourage students to affirm and take responsibility for their own education, seeing it not as an external imposition but as an inward expression of their hopes and potentials. This shift in the subjective meaning of the school for the child is of immense importance, but by themselves reformed schools, however meaningful, can be too easily left distanced from real channels of economic opportunity when the child and the school are starved for both capital and skills. Here digital communications transform schooling and make it significant for disadvantaged students, as they gain direct exposure to the levers of power and innovation in the global information economy and experience their education as a matter of developing their potential for productive action in this much larger arena. Digital technologies will provide all with a means of entry and action in the larger world.

2b4) Create Cultural Relevance within Community Experience

Educators must be careful to avoid a deficit model of education, especially when a high percentage of their students are disadvantaged. New technologies can radically alter the traditional politics of the curriculum, which have been narrow and exclusionary for centuries. For instance,

- Through collaboration with Columbia's African Institute, the Eiffel Project will use digital information resources to draw a diverse group of interested students from participating schools, into an ever-deepening engagement with traditions, cultural achievements, historical and contemporary realities.
- The Sister Clara Muhammad School, a participant in the Harlem Environmental Access Project, is already using its broad-band access to the World Wide Web to greatly strengthen its basic aim, a tri-lingual curriculum in Arabic, French, and English.
- At the Brooklyn New School -- a CCE school participating in the Eiffel project -- students speak 36 different languages. A teacher has high school students study westward expansion by conducting detailed analysis of diverse American family histories using multimedia resources. This year investigations included a slave family, two Sioux Indian families, an abolitionist family and a plantation-owning family.

As the Eiffel Project proceeds, it will build more and more channels linking the advanced study to the world's cultures and traditions with interested groups in the schools. It is often incanted as cause for dismay that New York City's school children speak over a hundred different native languages. By building links to the full range of cultural scholarship in universities, museums, and institutes, the Eiffel Project will make this multiplicity of linguistic and cultural identification one of the great strengths of the emerging educational system.

3) Implementation: A Research University Serving the Reformed School

In this section, we seek to explain our strategies for implementing the Eiffel Project, with sections on the needed technological infrastructure, development of content, and the provision of on-going support. New York City is one of those points where the energies and talents of the country and the world concentrate, and we seek through the Eiffel Project to bring these concentrated resources to bear on the challenge of using school reform, augmented through advanced media, to break the constraints of traditional schooling.

3a) Develop Good Technical Infrastructure

In extending high-speed Internet access to schools through the Harlem Environmental Access Project and the Living Schoolbook Project, we have learned the importance of adapting plans to the unique character of each school site and working with key people in each school to ensure that a full transfer of technical know-how takes place. We expect to bring at least 12 schools into the Eiffel Project each year during the life of the project, as well as two CBOs annually. In each location we seek to introduce essentially ubiquitous access to a robust, manageable infrastructure that readily accommodates future growth. The wide-area infrastructure will use T1 connections (1.5 megabits per second) for the most part, introducing ATM and/or cable modem connections when and if these become cost competitive and highly dependable. Our aim is to progress from initial broad-band connectivity to a fully developed technical infrastructure in the school through a series of four stages - 1) Preparatory Access; 2) followed by Base Connectivity, providing T1 connections, library access, and one classroom equipped for small-group problem solving; 3) Level One, equipping one third of the school's classrooms for such work; and 4) Level Two, making one computer per five students available in all the classrooms of the school. Early on in the project, 12 Media Centers, with 8 more added each year, will be created in key locations that will have important roles in promoting communication between localities served by the project and in developing the links between on-line portfolios and exhibitions as a means of assessment.

3b) Create Content: Potent Curricular Resources and Intellectual Tools

Key representatives from all project schools will function as participatory design teams, working with content and technical specialists. Curriculum development should take place as close to the classroom as possible. Our Technology Learning Challenge will match local, corporate and foundation funds with federal support to implement four interrelated educational applications of new media. These include:

- On-line curriculum development among Small Schools Partnerships practitioners and electronic dissemination of curriculum products via the Internet and the WWW to interested New York City K12 schools and other educators outside the City.
- Production and dissemination of multimedia student and teacher portfolios and school profiles in conjunction with the Eastman Kodak Company, using its technology for low-cost CD-ROM production.
- Design and implementation of diverse professional development activities, including Design Studios for Teachers modeled after those conducted by ILT in the context of HEAP.
- Implementation of Media Centers affiliated with participating schools that will serve as facilities supporting curriculum development, professional development, student research, demonstrations, new media workshops, and related research, development, implementation, and evaluation efforts.

CCE and ILT -- two organizations with extensive experience supporting innovative curricular reforms in small, restructured schools -- share a fundamental commitment borne out repeatedly by both organizations' experiences: for innovative curriculum development to succeed it must flow from teachers, and it must receive support and guidance from administrative structures. That is, neither a largely top-down nor a largely bottom-up model of design and implementation is likely to result in curricular innovation on a significant scale. Teachers must be deeply invested in curricular ideas that they share in germinating, and they must have access to informed counsel, support resources for development, evaluation capacity, and dissemination channels. Our proposal seeks to realize this interaction of classroom-level and system-level activity through the proposed Media Centers that will function as agencies helping to manage technology-enabled innovation at the appropriate level -- above the classroom, but below the overarching system. ILT's many formal evaluations of diverse educational technology initiatives, taken together, indicate that one difficulty mitigates the success of new programs far more than any other -- namely, inadequate coordination of distributed efforts. The Media Centers will provide the crucial management and support layer these studies have called for again and again.

Much of the exciting educational activity in Partnership Schools is ripe for enhancement through new media. At one participating CCE school, students studying momentum and deceleration in physics explored the dynamics of roller coasters using frame-by-frame analysis of a laserdisc. Then, they had to design and actually build their own roller coasters. Their designs were put to the test when a marble was rolled along the track; if it broke an egg at the end, students returned to the drafting table and the machine shop. This innovative project work could be profoundly enhanced by Computer-Aided Design tools. At Columbia's School of Engineering and Applied Science, numerous CAD-supported mechanical and electrical engineering design programs have been developed that can significantly extend these interdisciplinary math, physics, engineering and design curricula.

Portfolio assessment is at the core of most of this project-based curricular work at CCE schools. Exploring the ways that networked multimedia can enhance and/or transform the concept and role of the student portfolio must be a process characterized by both relatively unconstrained experimentation and careful monitoring. Teachers and students must be free to develop and pursue new projects and products, guided by their imaginations and, in the case of teachers, by their experience as educators, thus beginning to define the curricular forms of the 21st century. But they must also be situated such that their experimentation is as informed as possible and is thoroughly and formatively assessed. This means that teachers must be in on-going contact with colleagues experimenting in similar ways; they must have access to emerging technologies so they can explore them and consider possible classroom applications; they must have technical support for development and for implementation; they must work with formative evaluators who can help them plan and respond to outcomes rationally.

We envision the Media Centers as sites through which teachers and students will lead the way toward new curricula oriented around multimedia portfolios with precisely these development assets at hand. Students will use the Centers as research facilities during the course of their work; workshops and demos will be conducted at them; teachers will present their work to colleagues and to other interested parties; software development support will be provided; teacher-in-residence programs will locate particular teachers with strong experience in successful innovation at the Centers to work with other teachers on projects; libraries of multimedia resources will be housed in them and high-speed WAN connections at the Centers will provide opportunities for teachers to plan for a time when such broadband connectivity is ubiquitous. Different Centers will no doubt emphasize different areas of activity and develop different particular strengths. But all will be guided by the aim of providing a locale that brings together the range of development resources described above.

We should make it clear that the Eiffel Project intends to work systematically to reshape the whole curriculum and to do this over an extended period of time. The small schools movement in New York City involves whole schools and it is based on the proposition that each of those schools is responsible for the whole of its curriculum. The Eiffel Project proposes to develop the uses of advanced digital technologies in support of these small schools, facilitating their efforts to design and implement their curricula. We are not proposing a limited curriculum development effort targeted to specific subjects to be housed, in part, at Columbia University, and to be implemented in selected classes of selected grades in selected schools. We are instead proposing a thorough-going engagement by Columbia University and its affiliates with a fundamental City-wide effort to reshape the whole educational experience that children receive in schools, using digital technologies to bring academic and professional resources to bear in support of small schools reform in ways that have previously not been feasible. We expect general educational strategies, and the uses of technology to support them, modeled by the small school movement to scale out to the whole system and to affect the

educational experience of children throughout it. Participants in the Eiffel Project have an extensive track-record in changing the ethos of schooling through changes in teaching and learning and through technology programs that support a wide range of curricular initiatives - the Dalton Technology Plan (social studies, astronomy, chemistry, paleontology, English, French, art and design, geometry and algebra), the Living Schoolbook Project (English, Spanish, social studies, current events), the Harlem Environmental Access Project (earth science), the Columbia Gateway Engineering Lab (calculus, design), the Edison Project (chemistry), the Amiens Project and the Museum Educational Site Licensing Project (art history), the EarthView Project (earth science), Where Are We? (mapping and abstraction skills), Discovery Web (general science), the Reinventing Libraries Project and Library Power (digital libraries in support of the school curriculum), and so on. All of these efforts enable students to engage primary sources and real data, to work with powerful tools, to pursue difficult questions; they provide an open-ended curriculum consisting in diverse supports for student inquiry. In short, within the limits of available resources, we expect the digital pedagogy outlined above to affect the whole educational experience and to integrate technology throughout the school.

3c) Provide Students, Teachers, and Communities Enabling Support

Strong, on-going provisions for teacher development and support are essential. The Eiffel Project will hold design workshops during summers and will provide an on-going program of on-site support buttressed with "just-in-time" training delivered in classrooms over the project's desktop video-conferencing capacities.

The Institute for Learning Technologies has pioneered innovative professional development programs in the context of the Harlem Environmental Access Project that will be extended and further developed in the Eiffel Project. Design Studios for Teachers bring together teachers, technologists, content experts, and even students for extended, multi-session workshops on the development of curricular applications of networked multimedia. These Design Studios are more than mere technical training for teachers. Teachers work with the advanced technologies in the context of real curriculum development and in a setting where ILT associates and relevant content experts are at hand. The Design Studio is more a collaborative research and development think tank than it is teacher training in any particular technology. Advanced computer tools are brought to bear on complex educational problems by a cohort of experienced educators and educational technologists over an extended period of time. During the course of this work, teachers acquire significant technical facility in a broad range of applications and can return to their schools prepared to lead their colleagues in novel directions with new tools and resources. The Eiffel Project will feature numerous Design Studios, and the Media Centers will augment these formal workshops with less formal, but continuous, staff development through design.

4) Money, Management, and Evaluation

Through the Challenge Grant for Technology in Education, the Eiffel Project will receive \$7 million between October 1996 and September 2001, and the consortium backing it will raise \$11.2 million to complete planned initial work. The summary budgets for the five years are as follows:

[BUDGET INFORMATION AVAILABLE ON REQUEST]

The management structure for the Eiffel Project will ensure that all aspects of the project are carried out effectively. This structure includes four main management layers: a Directorship layer, an Implementation Management layer, a Lead Teacher layer, and an Advisory layer. The Directorship layer and the Implementation Management layer together form the Project Management Group.

The Directorship layer consists of the three Co-Principal Investigators. They will be responsible for the overall conduct of the project. They will convene and chair the Project Management Group; hire and appoint staff; convene Advisory Boards; submit annual reports; and be responsible for preserving the vision of the Eiffel Project throughout its operations.

The Implementation Management layer consists of three project managers: the Project Infrastructure Manager, the Project Content Manager, and the Project Support Manager. All three Project Managers will be responsible for advising the Co-PIs and serving in the Project Management Group. The Project Infrastructure Manager will be an ILT position and will have lead responsibility for technology options and decisions; for preparing assessments and technology plans for project schools; and for managing the installation and maintenance of the technological infrastructure of the project. The Project Content Manager, also an ILT position, will have lead responsibility for digital library resources and related educational programs; for working with scholars and professionals to develop curricular resources; and for collaborating with participating teachers to ensure that these resources are effective at the school and classroom levels. The Project Support Manager, a CCE position, will have lead responsibility for professional development within the project; for organizing Design Studios for Teachers; for utilizing the school Media Centers to promote understanding of the project among parents and community groups; and for implementing just-in-time support via desktop videoconferencing.

The Lead Teacher layer consists of a cohort of Lead Teachers -- one will be appointed at each school added to the Eiffel Project curriculum network -- responsible for helping the teaching staff at each participating school develop confidence with new equipment and become artful in using it in the classroom. Lead Teachers will serve as on-site liaisons with Project Support Teams, scheduling their visits and setting agenda for work with them. Lead Teachers will regularly apprise the Project Management Group of relevant developments relating to the organizational goals and pedagogical objectives of the overall project. They

should also serve as resource persons for the evaluation teams. Each connected CBO will identify a senior staff member to serve in a similar manner.

The Advisory layer consists of two advisory boards: the Parent-Community Advisory Board (P-CAB) and the School-University Advisory Board (S-UAB). The P-CAB will be formed of parent representatives and representatives of participating community organizations. It will meet regularly, sometimes with the Project Management Group, to discuss community participation and to plan strategy for enfranchising new community partners. It will also be responsible for coordinating public events relating to the project and its exhibition. The S-UAB will be formed of key teachers and university personnel associated with the project. It will meet regularly, sometimes with the Project Management Group, to discuss issues relating to interaction of the schools with Columbia and its constituent schools and departments.

Eiffel Project evaluation activity has four key interrelated objectives:

1. To guide the full extension of network connectivity to all schools in New York City and the greater New York region in accordance with models proven most appropriate through the project.
2. To produce a clear and well-grounded statement of proven ways universities can, through innovative use of new media, advance their research and educational agendas in conjunction with a vigorous and potent extension of resources to their surrounding communities.
3. To substantially increase understanding of diverse pedagogical possibilities emerging with the integration of advanced information and communication technologies in schools.
4. To provide leadership in the definition of effective policy relating to all aspects of the educational enterprise as they relate to the changing global information infrastructure and associated digital media.

To satisfy these objectives, the project will integrate four varieties of assessment work, each conducted by an organization skilled in that domain of program evaluation: school performance assessment; "sampling studies" of students' higher order critical skills of analysis; formative process assessment relating to administration, management, and execution at all levels of project implementation, as well as evaluation of the overarching development process; and school technology audits.

School performance assessments are an essential element of the restructuring process for many Coalition schools. As the school's curricular, temporal, and physical structures are re-engineered, the school is monitored for effects on student and faculty, and the implementation agenda is tracked as well. This assessment activity has both a summative and a formative dimension. Part of the aim is to document, through rigorous methods, the educational effects of the restructuring of the schools; the school performance assessment is also intended, however, to provide important formative information to individuals leading the redesign effort

of a particular school. New York University is currently conducting school performance assessment of many Annenberg-supported Coalition schools in New York City, and this work will be extended through the Challenge Grant to encompass the additional schools and particular technological issues related to the Eiffel Project. In particular, NYU evaluators will seek to identify ways that Coalition schools may benefit from participation in a large network of restructuring schools. The effects of the new media access and associated professional development activities on faculty will form a second important focus of study. The Eiffel Project's success is heavily predicated on its strategies for empowering teachers with new skills, new tools, and substantial support resources. Much of NYU's school performance assessment will examine the effectiveness of these efforts, with both formative and summative objectives.

"Sampling studies" will help determine the extent and nature of the projects' effect on students' critical skills. Much of the curricular development associated with the project will be aimed at enhancing students' abilities to address complex problems with sophisticated tools in diverse disciplines and reflecting those abilities in digital portfolios. As part of the Eiffel Project's assessment, the National Center for Research on Education, Students, and Teachers (NCREST) will investigate the effects of the project on critical thinking skills. NCREST will conduct controlled studies with samples of students. In these studies, students will receive a battery of unfamiliar problem solving situations, testing their approaches to the problems. The evaluations will consider a range of abilities, including students' ability to orient themselves in a new problem area; to formulate a well-conceived experimental plan; to understand implications of findings and of new information; to consider a question or problem from diverse perspectives; to use, make sense of, and dismiss evidence of various kinds; and to communicate understanding.

In addition to formative evaluation of particular curricular initiatives at each school, a project of this scale demands formative assessment of the development process at the macro-level. Project leaders need feedback relating to the strengths and weaknesses of the inter-institutional collaboration; they need to understand which administrative structures are encouraging good innovation and which are hindering it; they need to be apprised of emerging patterns of difficulties at the distributed school sites and of patterns of success as well. The Institute for Learning Technologies conducts such process-oriented formative assessment in the context of all its projects, and ILT will implement this level of assessment for the Eiffel Project as well. Because a primary goal of the project is to marry the academic resources of a major research university to the restructuring program of an established reform movement, it will be important to monitor continuously the extent to which these interactions are occurring with good effect. The Institute has substantial experience exploring the use of networking technologies to support such inter-institutional collaboration; a major focus of this area of assessment will be building on that accumulated knowledge through prototyping of new arrangements, including substantial use of desktop videoconferencing over the Internet. Finally, the Institute for Learning Technologies will conduct full

technology audits of all schools entering the project. These audits will be used to guide infrastructure and hardware development plans at each site. The evolution of each participating school's technological assets will be documented as it unfolds by the institute, and this documentation will contribute to overall evaluation efforts.

We plan to disseminate the findings of the project by drawing up two plans to extend the Eiffel model to larger areas and by publishing three detailed evaluation studies that will be accessible not only to educators but to the wider public. The two plans we will develop are:

1. New York City Board of Education Plan: This will be a validated model for extending technology to all schools served by the NYC Board of Education.
2. NY Metro Area Plan: This will be a plan for the entire New York Metropolitan region, designed to maximize the use of its high-level intellectual and cultural resources for the improvement of K-12 education.

The three evaluation studies are:

1. Innovation Study: A study of the processes of innovation and school change as driven by advanced technologies.
2. Curricular Change Study: A study of the interrelationship between technological change and curricular change, and the effects of these changes on student learning.
3. Teacher Development Study: A study of the recommended strategies for teacher support and staff development.

We also plan to develop a Technology and Pedagogy Workshop, through which we will work with advanced engineering groups and their collaborators from engineering and technology firms, as well as from the New York area software and telecommunications companies, to foster the process of what we call "pedagogy transfer" - the transfer of pedagogical experience from the schools to the advanced technology companies - so that their technology-development work will become better informed by our educational experience. In addition, we will organize one or more conferences toward the end of the project. Web development will proceed continuously throughout the project, both as a mean of supporting internal implementation and as a means of making the project available to a broader set of interested parties.

In our view, however, the dominant dissemination issue for project work ensconced within the National Information Infrastructure is how to scale the project up. As discussed in section 2a4, multimedia portfolios representing students', teachers' and whole schools' work will be used to share this work both within and beyond the Eiffel Project's network. And participants will routinely interact with peers and colleagues on the Internet in the course of their work. Dissemination is part and parcel of wide-area networked project work. The real question is how to extend the project itself.

5) Resources for Scaling the Project Up

Winning proposals in the competition for Challenge Grants for Technology in Education will receive substantial funding for five years, with the requirement to match that federal funding, at least on a one-to-one basis, from non-federal sources. In the case of the Eiffel Project, the Challenge Grant is \$7.1 million over five years, with \$11.2 million required from consortium partners in order to meet the project challenge. But to succeed, the Eiffel Project must be even larger in scale, involving many children and teachers, sustaining its influence over a prolonged period, showing that educational attainment spread out on an entirely different spectrum of achievement is both possible and feasible. The consortium therefore seeks to double those goals through additional fund-raising, and to extend the project at least five years further into the 21st Century, in order to have transformative effects on educational achievement in New York City and the region.

Consider the key question. What is the necessary order of magnitude -- in time and expense -- required to demonstrate unequivocally the feasibility of significant improvements in the educational attainments of all children, doing it with palpable effect within greater New York, one of the 20 to 30 large metropolitan regions in which most of the world's population now lives? Each year, New York City has roughly 1 million students in its public schools. We propose to demonstrate that the educational process those million children experience day in and day out can become significantly more effective for each and all of those students. What portion of the million students does the demonstration need to influence in order to demonstrate something feasible and significant for all of them? Year after year, each of those million children in the public schools is working cumulatively on his or her whole education, which cannot really be disaggregated into a plethora of parts according to grade and subject. A reform of the educational process is not necessarily a simple function of the reform of 5th grade social studies or 9th grade earth science. What portion of the whole child's whole educational experience needs to be encompassed within a project for that project to demonstrate significant and feasible reform of the educational system?

Assume the Eiffel Project fulfills the goals reflected in the proposed budget for the Challenge Grants for Technology in Education. What level of demonstrative presence will it have attained? Approximately 70 schools will have been wired to the Internet with broadband connections and active access through this in the library and at least one classroom that has been adapted for small groups using computers to learn through problem solving. Two-thirds of the schools will also have media centers to further exploit the connectivity, with each student being able to work in the center about one period per week. One-third of the schools will have equipped one-third of their classrooms with multiple computers (on a 1:5 student ratio), also adapting those classrooms for a problem-solving pedagogy. Five schools would have extended this classroom model to all its classrooms. At the end of five years, 30,000 students, 3% of the City's public school population, would have started to use sophisticated connectivity about 10% of their time in their

educational program. Ten thousand of those students, about 1%, would have started to use it about a third of their time; and 2,500, 0.25%, would have started to use it all of the time. Finally, at the end of five years, the average duration of these use levels would have been 2.5 years, not a long time in view of the fact that we require each child to engage in 12 years of schooling, often preceded by 2 years of pre-schooling and 4 or more years of post-secondary education. Relative to the goal of providing a decisive demonstration that significant improvements in the educational process for all children in a major metropolitan system are feasible, these use levels are low and their duration short. Hence, although the Eiffel Project can get an invaluable start through the Challenge Grants for Technology in Education, it cannot really succeed by fulfilling its goals alone. To do that, the Eiffel Project must unfold on a considerably larger scale and last for a considerably longer period. For this reason, a long-term funding program is essential.

Financial support for the Eiffel Project will aggregate from four sources. First, the Project will receive an average of \$1.4 million annually for five years from the U.S. Department of Education. Second, the sponsoring coalition will provide substantial matching resources through contributed effort, equipment, services, and talent. Third, the sponsoring coalition is raising funds for component activities within the project from diverse granting agencies -- federal, state, local, and private. Fourth, the Eiffel Project will raise funds systematically to support the work of the project from a wide cross-section of New York City businesses and philanthropies.

The table below summarizes these funding goals.

[FUNDING INFORMATION AVAILABLE ON REQUEST]

Examples of non-federal grants that will be available for the first year are a \$293,000 grant by the New York State Science and Technology Foundation to the Institute for Learning Technologies for the Living Schoolbook Project, which will be included within the Eiffel Project; New York City Council funding for technology to the Frederick Douglass Academy in the amount of \$200,000; and significant portions of the Annenberg Foundation's grant to start Networks for Learning Renewal. Many sources of federal funds can strengthen the over-all capacities of the Eiffel Project and we will continue to seek funding for curriculum development, networking infrastructure, teacher development, and evaluation projects from the National Science Foundation, other parts of USDE, the Department of Commerce, and other agencies.

As important as these sources are likely to be, corporate support and private philanthropy will probably be the most fruitful way to expand the Eiffel Project to the required scale and duration. The business and philanthropic communities of the entire New York region have two strong reasons why backing the Eiffel Project at a substantial level of support, over an extended period of time, makes good sense. First, competitiveness and economic health: the strength of New York City and its surrounding region, as well as the strength of the corporations doing business there, depends increasingly on success in the information economy. When it was an

industrial manufacturing center, New York needed to attract a docile, low-skilled workforce. With manufacturing in significant decline and the information industries its main source of competitive advantage, the City needs a highly educated and educable workforce, and educational excellence, attainable by all, becomes increasingly important to its economic strength. It is imperative to show, through efforts such as the Eiffel Project, that the least advantaged in the Metropolitan Region can succeed in the complex, high-skilled, ever-changing job markets around them by making full, disciplined use of the new educational resources to which they have access. Here are the numbers for New York City (from a recent New York Times article):

Job-base:	3,300,000	over 20% held by suburban commuters
Total net job gain since 1992:	88,000	1992 was a recession bottom; net gain predominantly in knowledge-industry jobs.
Unemployed in NYC:	271,000	not on welfare, looking for work
Adults on welfare in NYC:	470,000	will be required to seek work

Second, a great cosmopolitan center is a very effective way to attract and concentrate the diverse, exuberant talents needed in centers of communication and intellectual creativity. To attract such talents spontaneously, the conditions of life need at once to be safe and civil while pulsating with cultural vibrancy. Such conditions will best thrive where educational opportunities are both extensive and excellent, and where participation in them is universal. The City needs nothing short of the very best educational opportunities for all its citizens.

Beyond this need, New York City and its region have remarkable advantages with which to become the educative leader for the 21st century. It makes sense to concentrate large-scale effort on a technology learning challenge here, and the sources of corporate and private philanthropy in the City and region are sufficient to underwrite such a sustained, unparalleled effort. This effort is the key to scaling the Eiffel Project into one of crucial importance to the historic reform of education.

But a Technology Learning Challenge must also address issues of scaling explicitly -- how can it provide a generally applicable model for implementation elsewhere? Discussion of scaling should identify key dimensions along which scaling proceeds. We concentrate on four:

- Scope: How to scale across the full intellectual scope of a child's educational experience.
- Penetration: How to scale to affect the whole community, not just its most favored parts.
- Reach: How to scale out to all locations and draw from all sources so that it is universal in both availability and import.
- Resources: How to scale up funding and participation sufficient to produce

historical change.

Too much technology in education lacks scope with respect to the full process of education as a person develops from early childhood into a productive adult. Scaling up means going from isolated products to changes in the whole process, changes that encompass the entire educational experience. The Eiffel Project will work to scale up with respect to scope by building up coverage of more and more subjects through digital resources, interacting with a wider and wider range of mentors and experts, developing an extensive repertoire of problem-solving resources, and generally through curricular resources and intellectual tools. A strength of the Eiffel Project as it unfolds over time is the thorough-going involvement of a major research university, for we need to work systematically to reshape the whole curriculum and to do it over an extended period of time in which the cumulative effects of an entirely restructured educational process can become evident and fully effective.

The Eiffel Project in its fundamental character is an effort to scale up with respect to penetration, for it addresses the needs of under-served populations directly, working primarily in schools serving predominantly African-American, Latino, immigrant, and economically disadvantaged children, specifically including Schools under Registration Review among those it seeks to reach, and cooperating with key groups such as the Upper Manhattan Empowerment Zone. As disparities of income are dangerously increasing in contemporary life, so disparities of education widen. New York City can become a serious dystopia, leading the nation to a two-tiered future of fundamental division between haves and have-nots, if these disparities are not ameliorated effectively in practice. New York City must find ways to integrate its large disadvantaged groups into the electronic future. The Eiffel Project will address that problem and the City needs to sustain the integrating, democratizing effort for the sake of its long-term economic strength, and for its civility as a vibrant human habitat.

As a specific test of its reach, that is, its scalability to other localities beyond New York City, the Eiffel Project is working in the Kingston-Newburgh Enterprise Zone to see whether educational resources we are developing in New York City schools and locales will prove useful in the Newburgh Enlarged City School District, specifically in improving educational opportunities for African-American and Latino families living in Newburgh's depressed downtown section. Newburgh is representative of numerous small to mid-sized cities where the affluent have abandoned downtown areas in favor of near-by suburbs, leaving behind a weak commercial core with a run-down housing stock, high unemployment, and a local political impetus to avoid and neglect these growing ghettos. Long-range plans, for instance that recently released by the Regional Planning Association, put a high priority on the resuscitation of these decaying downtown centers in order to reverse environmental degradation arising from unchecked suburban sprawl and to energize the overall economy, which has been left stagnant by the decline of industry and manufacturing. Newburgh's downtown, in its demographics, its needs, and its opportunities, is much closer to Harlem, the South Bronx, or Bed-Stuy, than

it is to its contiguous communities. We postulate that what the Eiffel Project does in these New York City areas will have great relevance to improving educational opportunity and general economic strength in areas such as Newburgh, which, like New York, must succeed in the information economy, and we will work with the schools there and an innovative housing renewal project to test this postulate. This will entail establishing high-speed Internet connections to the Newburgh schools and extending new pedagogical resources to children through the schools and to their homes, particularly those resources concerning participation in civic life, engagement in the workplace, and developing distinctive cultural strengths. Should it prove successful, it will chart an important path for extending the reach of the Eiffel Project to other places with similar problems throughout New England, the Mid-Atlantic, and Mid-Western states.

Resources deployed through the Eiffel Project could expand in scale almost limitlessly: first, by deploying a more and more complete, state-of-the-art technological infrastructure in, between, and around participating schools; second, by developing all the interesting opportunities for new curricular tools and resources that pertain to full education of the whole person living in a complex world; third, by providing fuller and fuller support to teachers, students, and parents engaged in the activities of school reform and the educational use of technology, and fourth, by including more and more schools within New York City, its region, the country, and around the world, all serving children of vast, undeveloped human potentials. The true learning challenge is to trigger a chain reaction of further effort by empowering key elements and energizing them to draw more and more resources into the work.

New York City and the region have great strengths, distinct competitive advantages in an effort to become an essential center of educative leadership in the 21st century -- an extraordinary concentration of major universities, numerous centers of corporate research, and unparalleled concentrations of cultural holdings in major museums and libraries. The Eiffel Project must mobilize all these advantages. It must capture the public imagination and command its participation. It can, by pursuing its essential objective -- to meet progressive expectations with a high-profile, large-scale project that will demonstrate that the small schools reform movement, empowered with advanced media, can break the constraints of the traditional school, thereby enabling all children to achieve unprecedented levels of excellence.

Appendix 1: Eiffel Project Consortium Partners

The Center for Collaborative Education and the Institute for Learning Technologies, the consortium co-conveners, seek to create an open, growing effort supporting the Eiffel Project. To join the consortium, please contact either Heather Lewis or Priscilla Ellington at CCE (212 348 7821) or Robert McClintock at ILT (212 678 3375).

Access Information Fund, Inc.
Center for New Media
Columbia University Graduate School of Journalism
Center for Research on Information Access
Columbia University
Community School District Five
Community School District Four
Countee Cullen Public Library
Eastman Kodak Company
Education Solutions and Services
Educational Video Center
Environmental Defense Fund
Fund for New York City Public Education
Harlem Parents Tutorial Project
Image Technology for New Media Center Columbia University
Institute of African Studies Columbia University
Junior Achievement of New York, Inc.
Lander Street Partners
National Center for Research on Education, Students and Teachers
Teachers College, Columbia University
Newburgh Enlarged City School District
New Laboratory for Teaching and Learning The Dalton School
NYNEX
State Education Dept./The University of the State of NY/Albany, NY
Office of New York City School and Community Services Intra/Interagency Team
Upper Manhattan Empowerment Zone Development Corporation

Appendix 2: Eiffel Project Partner Schools

[more schools will be added as the project continues]

Benjamin Banneker Academy
Bronx New School
Brooklyn New School
Center School
Central Park East I
Central Park East II
Central Park East Secondary School
Coalition School for Social Change
Community Service Academy
Computer School
Crossroads School
Early Childhood Center

Earth School
Frederick Douglass Academy
Henry Highland Garnet School
Institute for Collaborative Education
International High School
Landmark High School
Lower East Side School
Manhattan New School
Manhattan School for Children
Manhattan Village Academy
Mary McLeod Bethune School C.S. 92
Metropolitan Corporate Academy
Middle College High School, , LaGuardia
Middle College High School, Medgar Evers
Mott Hall School (I.S. 223)
New School
Neighborhood School
New Program at P.S. 261
Northview Tech for Communications Arts and Computer Sciences
Oceanhill Brownsville School
P.S. 234
Public School Repertory Company
Ralph Bunche School, P.S. 125
River East
Satellite Academy, Chambers
Satellite Academy, Forsythe
Schomburg Satellite Academy
School for the Physical City
School of the Future
Science Skills Center High School
Sister Clara Mohammed School
University Heights High School
Urban Academy
Vanguard High School
Wadleigh School for Science and Technology

Appendix 3: Project Directors

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Priscilla Ellington is Co-Director of the Center for Collaborative Education, with particular responsibility for the Elementary School Change Services, which provides professional development opportunities and consultation. She is a parent who helped establish the Brooklyn New School. Before joining CCE, she designed training tools in both visual and print media for professional development, outreach, and public information.

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Heather Lewis has been Executive Co-Director of the Center for Collaborative Education since its founding in 1988. She has worked as a parent organizer in District 15 (Brooklyn), where she helped create the Brooklyn New School. She has been a member of the steering committee of the Cross City Campaign for Urban School Reform since 1993. Ms. Lewis will be a Revson Fellow at Columbia University for academic '96-97.

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Robert McClintock is Director of the Institute for Learning Technologies, Columbia University and a professor in the Departments of Philosophy and Social Sciences, and Communication, Computing and Technology, at Teachers College. He is Co-Director of the Dalton Technology Project, New Laboratory for Teaching the Learning, and he has been principal investigator for two projects that bring high-speed networking to inner-city schools, the Harlem Environmental Access Project, funded in 1994 by TIIAP, and the Living Schoolbook Project, supported since 1994 by the New York State Science and Technology Foundation.

For additional information please contact:

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HTML V1.1.1a July 1997