Risk and Renewal

First Annual Report -- 1991-1992

The Phyllis and Robert Tishman Family Project in
Technology and Education

New Laboratory for Teaching and Learning
The Dalton School
1992

To the Dalton Community:

A year ago the Phyllis and Robert Tishman Family Fund gave the Dalton School $2 million to integrate information technology into its educational programs. In the pages that follow, we give a full report on the activities initiated as a result of Mr. Tishman's vision and generosity.

To participate in the Project teachers, staff, and students need to take risks, for it requires us to set familiar practices aside in order to create new ones. It promises renewal in return. That is the theme of our report and of our project -- *risk* and *renewal*. Robert Tishman exemplifies for us all that capacity to accept risk and to achieve renewal.

Two lines of effort led to the Tishman Project, one theoretical and one developmental. These provide the foundation for the intense and extensive activity of the past year.

First, through the theoretical effort, over the past few years several of us have been asking how information technology may alter educational practice. We approach this question from a grounding in history and philosophy. We think that new communications resources, especially high-speed digital networks and interactive multimedia, will profoundly change the curriculum and the way students and teachers can work with it.

With the full use of information technologies, the educational resources of a school will be ubiquitously available and they will be far more extensive and powerful than those currently available to students and teachers. Two features, we think, will be of transformative importance.

- First, all the materials pertaining to the curriculum will be accessible to any student or teacher at any time. The curriculum will cease to be a sequence of compartmentalized units.
- Second, the scope of the materials included in the curriculum,

while not boundless, will be much greater than the print-based resources it can currently comprise. The curriculum will provide multiple paths to the highest levels of achievement in all domains of the contributing culture.

These two features -- a transformation of scope and a transcending of sequence -- will profoundly alter the constraints of the current system, radically changing its limits and methods, facilitating an education more responsive to the potentialities of students.

Second, through the developmental effort, work had begun at Dalton through the New Laboratory for Teaching and Learning on innovative programs in technology and education. Starting in 1988, the New Lab initiated design and development work on two programs that are now coming to significant fruition -- *Playbill*, an interactive multimedia system for studying dramatic literature, and *Archaeotype*, a cooperative, archaeological simulation for the study of history. In addition, Malcolm Thompson had begun to explore the possibilities of using computer-based sky simulations as a means of reorganizing his High School Astronomy elective and a group of seniors, sponsored by the New Lab, created a history elective, the *Civil War CD-ROM*. All these projects have burst into flower with the added support of the Tishman Project and external evaluations of them form the centerpiece of this Report.

In addition to these four projects, numerous other activities have been initiated during the past year. In the First Program, we are endeavoring to introduce a coordinated use of computers in every classroom. Moreover, we are setting up a model technology center in the 91st Street building in which classes can work more intensively with tools of inquiry and communication. In the Middle School, we seek to integrate computer resources into the study of writing and mathematics and are working closely with the Director and Faculty in a major reorganization of the program and schedule in the sixth, seventh, and eighth grades. In addition, extensive further development of *Archaeotype* is taking place, extending its historical scope to new sites. Similar in spirit, *Ecotype* is a new simulation under development in the earth and life sciences. In the High School, while *Playbill* in English, *Project Galileo* in Astronomy, and the *Civil War Project* in History are moving forward, other areas of initiative are gaining momentum -- Foreign Language, possibly Chemistry, and certainly Art and Architecture.

During our first year, initiation of the Dalton Network and Multimedia Library consumed much effort. The library will comprise a comprehensive, selective representation, in digital form and multiple formats, of key-phenomena of the world and of humanity. It will include a full repertoire of the cultural tools that people use to interpret these phenomena, in examples that range from the most simplified to the highly sophisticated. With the network, we seek to make these resources available throughout the school.

In all, during 1991-92, the project spent $1,010,000, with a similar amount budgeted for 1992-93. For the past year, $475,000 went for faculty and staff salaries and wages, about half for Tishman Project staff and half for members of Dalton's faculty and administration. $435,000 were spent on equipment, the bulk of it for computers and accessories and a bit over $100,000 for network installation and components. An additional $79,000 went for materials -- space renovations, software, and the like. We give fuller details on expenditures in Section 6.

For 1992-93, we expect a year of sustained, intense activity. 1991-92 was a start-up year with many energies absorbed in the initial implementation of systems and programs. During the coming year, we will have more time and energy for reflective practice. It will be an opportunity to understand the educational dynamics of our projects. These seem to share some important characteristics. An editor of *Electronic Learning* recently spent a morning looking at different projects and the work students did through them. Toward the end, she observed that she had seen elsewhere innumerable fruits of computer-based activities that students had conducted but those at Dalton stood out remarkably for their substantive depth and their intellectual consequence.

This observation points to an important quality of the educational innovations that we are implementing through the Tishman Project. Our programs do not teach; rather they engage students in the work of scholarship and inquiry. Consequently, our programs result not primarily in predictable learning, but, more importantly, in activities of intelligent inquiry. In the coming year, we should extend the reach of these programs further through the school and attend to their dynamics more reflectively. And we should ask incessantly, 'What makes these programs work educationally?'

To accomplish this, we should devote sustained attention to some difficult questions. Can we develop a better understanding of how students learn and develop with intensive use of information technology? Can we document the ways in which this learning and development differ from that in traditional settings? Can we explain to ourselves and others the principles which make it happen? In the pages that follow, there are many hints of answers to such questions. The Tishman Project, the New Lab, and the Dalton School are sites of immense educational vitality because daily experience puts such questions to us all.

Co-Directors of the Tishman Project:

Frank A. Moretti, Executive Director, the New Laboratory for Teaching and Learning; Associate Headmaster, The Dalton School

Robert McClintock, Director, The Institute for Learning Technologies, Teachers College, Columbia University

Luyen Chou, Associate Director of the New Laboratory for Teaching and Learning

Thomas de Zengotita, Teacher, The Dalton School; Professor, New York University

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1) Introduction

"The Finest School in America"

June 20, 1992

Dr. Gardner P. Dunnan
The Dalton School
108 East 89th Street
New York, NY 10128

Dear Dr. Dunnan,

Thank you for your very kind and flattering letter, which I truly appreciated. I felt honored when elected Master of Ceremonies of our graduation, and relished the once in a lifetime opportunity to bring together the students, parents and faculty in a final affirmation of self-achievement through the generosity, intelligence and love for education of the group. Indeed, after speaking with many friends and parents, I think the ceremony successfully engendered reflection on the past, and became a real spiritual, emotional catalyst for optimistic dreams of the future.

> "If it ain't broke, don't fix it!" Why risk change at Dalton? Its leadership is strong; its teachers are dedicated and humane; its students excel. The cliché of complacency would seem to apply here, if anywhere. Yet two reasons demand that we nevertheless risk renewal.
>
> First, however good Dalton's education may be, American education as a whole is broke. In a floundering system, elite schools cannot stand on their laurels. If the best cannot innovate, cannot improve, there is little hope that mediocre and lagging institutions can fix the system.
>
> Second -- a point deftly grasped in this letter from a recent graduate -- Dalton's links to its own unique traditions, if not broken, are tenuous. The Children's University School, built to nurture education through experience according to the Laboratory Plan, has become a pre-eminent college-preparatory school. External pressures -- SAT's, predictable coverage of the standard subjects -- increasingly shape our practice. Dalton can innovate and lead by renewing its own traditions -- that is the essential purpose of the *New Laboratory for Teaching and Learning.*

Speaking from my own experience at Dalton, I certainly cannot thank you enough for heading an institution that has shaped so much of my mental and spiritual life. How can a child thank its parents for creating it? The human infrastructure of Dalton's system of education coupled with the irreplaceable gifts of the teachers themselves have mothered and fathered me in the vast and sometimes confusing world of information. Dalton has laid a solid yet pliable foundation for my character, which at this point interweaves all of my personal experiences with the set standards of knowledge. As a result of my five years there, my strong motivation to create the new standards has been given the means to specify and realize what were once barely comprehensible impulses, which I feel will be further galvanized by the accumulation of time and thought. If invisible knapsacks do exist, then Dalton packs them well and leaves plenty of room for personal belongings.

However, before I disappear into the jungle, I feel the necessity to leave some affective words of gratitude for the idealism and humanity of the teachers at Dalton, whose qualities and presence in the school environment reach far beyond the plainness of a text, and so subtly yet powerfully introduce us into that exciting realm of abstraction, otherwise known as the mind. They are truly amazing.

But as society changes so must its education, and I hope you will continue to support and expand the necessary innovations implemented by teachers and departments such as the New Laboratory for Teaching

> Here is the challenge we face through the Tishman Project. The aim is not to shape the education that Dalton offers according to some external model. The pressures of pedagogic conformity have been doing that for many decades. Instead, the aim is to renew from within, to return to the ideas of the Dalton Plan, finding in new technologies of communication ways to strengthen its original aims.
>
> Progressives animated the educational experience, but had difficulty upholding high intellectual standards. Traditionalists preserved standards, but found it hard to engage many students in their educational pursuits. We aim to use technology in the school to raise the quality of intellectual achievements while engendering in students a greater, more active sense of engagement and responsibility.

and Learning. Because as a student, the removal of deeply ingrained confines in the classroom is like a Renaissance of the learning process, especially when the teacher discovers new concepts as well. Although I am very content with my education so far, it was built on a tangent to the Dalton Plan, the ideals of which I hope will increasingly become realized into the structure of what I consider the finest school in America.

Sincerely,

Michael Goldstrom
Class of 1992

* * *

Helen Parkhurst on the Dalton Laboratory Plan

BROADLY speaking the old type of school may be said to stand for *culture*, while the modern type of school stands for *experience*. The Dalton Laboratory Plan is primarily a way whereby both these aims can be reconciled and achieved.

> The Dalton Plan is part of a long tradition of educational renewal. "The letter killeth; the spirit teacheth." Students need to possess and take responsibility for their own educations. They are their own most powerful educators. The Dalton Plan served to use this essential drive in education.
>
> Like other great educational reformers from the ancients on, Helen Parkhurst sought to join *culture* and *experience* together, inextricably, as the foundation for educative work. Information technologies will enable the renewal of education if they empower students and teachers to link culture and experience more productively in their work. Innovations supported by the Tishman Project should improve the access students have to significant elements of the culture, while making their accessing it ever more meaningful in their experience.

The acquisition of culture is a form of experience, and as such is an element in the business of living with which school ought to be as intimately concerned as is adult existence. But it will never become so until the school as a whole is reorganized so that it can function like a community -- a community whose essential condition is freedom for the individual to develop himself.

This ideal freedom is not license, still less indiscipline. It is, in fact, the very reverse of both. The child who "does as he likes" is not a free child. He is, on the contrary, apt to become the slave of bad habits, selfish and quite unfit for community life. Under these circumstances he needs some means of liberating his energy before he can grow into a harmonious, responsible being able and willing to lend himself consciously to cooperation with his fellows for their common benefit. The Dalton Laboratory Plan provides that means by diverting his energy to the pursuit and organization of his own studies in his own way. It gives him that mental and moral liberty which we recognize as so necessary on the physical plane in order to insure his bodily well-being. Antisocial qualities and activities are, after all, merely misdirected energy.

Freedom is therefore the first principle of the Dalton Laboratory Plan. From the academic, or cultured, point of view, the pupil must be made free to continue his work upon any subject in which he is absorbed without interruption, because when interested he is mentally keener, more alert, and more capable of mastering any difficulty that may arise in the course of his study. Under the new method there are no bells to tear him away at an appointed hour and chain him pedagogically to another subject and another teacher. Thus treated, the energy of the pupil automatically runs to waste. Such arbitrary transfers are indeed as uneconomic as if we were to turn an electric stove on and off at stated intervals for no reason. Unless a pupil is permitted to absorb knowledge at his own rate of speed he will never learn anything thoroughly. Freedom is taking his own time. To take someone else's time is slavery.

> Progressive reformers understood how the division of the day into periods and the culture into subjects impeded the intellectual work of the child. They did not, however, analyze in sufficient depth the reasons why educators have resorted to such compartmentalization -- universally over many centuries of practice. Consequently, their efforts to change this practice have not endured.
>
> At Dalton today, the period and the subject are again basic categories of educational experience. As we develop the uses of information technology in the school, we will be creating conditions in which the child can manage his time, "free to continue his work upon any subject in which he is absorbed without interruption."

The second principle of the Dalton Laboratory Plan is co-operation or, as I prefer to call it, the interaction of group life. There is a passage in Dr. John Dewey's *Democracy and Education* which admirably defines this idea. "The object of a democratic education," he writes, "is not merely to make an individual an intelligent participator in the life of his immediate group, but to bring the various groups into such constant interaction that no individual, no economic group, could presume to live independently of others."

Under the old educational system a pupil can and often does live outside his group, touching it only when he passes in company with his fellows over the common mental highway called the curriculum. This easily ends in his becoming antisocial, and if so he carries this handicap with him when he leaves school for the wider domain of life. Such a pupil may even be "an intelligent participator" in the life of his form or class, just as a teacher may be. But a democratic institution demands more than this. Real social living is more than contact; it is co-operation and interaction. A school cannot reflect the social experience which is the fruit of community life unless all its parts, or groups, develop those intimate relations one with the other and that interdependence which, outside school, binds men and nations together.

Conditions are created by the Dalton Laboratory Plan in which the pupil, in order to enjoy them, involuntarily functions as a member of a social community. He is accepted or rejected by this community according as his functioning, or conduct is social or the reverse. The law operates in school just as it does in the world of men and women. To be effective this law must not be imposed, but unwritten, an emanation as it were of the atmosphere breathed by the community. The value of community life lies in the service it renders in making each free individual composing it perpetually conscious that he, as a member, is a coworker responsible to, and for, the whole.

This constitutes a problem in school procedure. It should be so organized that neither pupil nor teacher can isolate themselves, nor escape their due share in the activities and in the difficulties of others. We all know the teachers who hang up their personality each morning as they hang up their coats. Outside school these people have human interests and human charm which they do not dare to exhibit when with their pupils lest they should in so doing seem to abrogate their authority. The Dalton Laboratory Plan has no use for the parade of such fictitious authority, which is restrictive, not educative. Instead of promoting order it provokes indiscipline. It is fatal to the idea of a school as a vital social unit.

EDUCATION
ON
THE DALTON PLAN

BY

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Equally, from the pupil's point of view, is the child when submitted to the action of arbitrary authority and to immutable rules and regulations, incapable of developing a social consciousness which is the prelude to that social experience so indispensable as a preparation for manhood and womanhood. Academically considered, the old system is just as fatal as it is from the social point of view. A child never voluntarily undertakes anything that he does not understand. The choice of his games or pursuits is determined by a clear estimate of his capabilities to excel in them. Having the responsibility of his choice his mind acts like a powerful microscope, taking in and weighing every aspect of the problem he must master in order to ensure success. Given the same free conditions his mind would act on the problems of study in exactly the same way. Under the Dalton Laboratory Plan we place the work problem squarely before him, indicating the standard which has to be attained. After that he is allowed to tackle it as he thinks fit in his own way and at his own speed. Responsibility for the result will develop not only his latent intellectual powers, but also his judgment and character.

But in order that he may accomplish this educative process -- in order that he may be led to educate himself -- we must give him an opportunity to survey the whole of the task we set. To win the race he must first get a clear view of the goal. It would be well to lay a whole twelvemonth's work before the pupil at the beginning of the school year. This will give him a perspective of the plan of his education. He will thus be able to judge of the steps he must take each month and each week so that he may cover the whole road, instead of going blindly forward with no idea either of the road or the goal. How can so handicapped a child be expected to be interested in the race even to desire to win it? How can a teacher hope to turn out a well-equipped human being unless he takes the trouble to study the psychology of the child? Both for master and for pupil a perception of their job is essential. Education is, after all, a co-operative task. Their success or failure in it is interlocked.

Children learn, if we would only believe it, just as men and women learn, by adjusting means to ends. What does a pupil do when given, as he is given by the Dalton Laboratory Plan, responsibility for the performance of such and such work? Instinctively he seeks the best way of achieving it. Then having decided, he proceeds to act upon that decision. Supposing his plan does not seem to fit his purpose, he discards it and tries another. Later on he may find it profitable to consult his fellow students engaged in a similar task. Discussion helps to clarify his ideas and also his plan of procedure. When he comes to the end the finished achievement takes on all the splendour of success. It embodies all he has thought and felt and lived during the time it has taken to complete. This is real experience. It is culture acquired through individual development and through collective co-operation. It is no longer school -- it is life.

Not only will this method of education stimulate the deepest interest and the highest powers in a student, but it will teach him how to proportion effort to attainment. In his book upon the principles of war General Foch says: "Economy of forces consists in throwing all the forces at one's disposition at a given time upon one point." So the child's attack upon his problem of work should be facilitated by allowing him to concentrate all his forces upon the subject that claims his interest at one particular moment. He will in this case not only do more work, but better work too. The Dalton Laboratory Plan permits pupils to budget their time and to spend it according to their need.

"The secret of education," so Emerson tells us, "lies in respecting the pupil. It is not for you to choose what he shall know, what he shall do. It is chosen and fore-ordained and he alone holds the key to his own secret. By your tampering and thwarting and too much governing he may be hindered from his end and kept out of his own. Respect the child. Wait and see the new product of nature. Nature loves analogies but not repetitions. Respect the child. Be not too much his parent. Trespass not on his solitude.

"But I hear the outcry which replies to this suggestion: Would you verily throw up the reins of public and private discipline; would you leave the young child to the mad career of his own passions and whimsies and call this anarchy respect for the child's nature? I answer: Respect the child, respect him to the end, but also respect yourself. Be the companion of his thought, the friend of his friendship, the lover of his virtue, but no kinsman of his sin. He makes wild attempts to explain himself, and invokes the aid and consent of the bystanders. Baffled by want of language and methods to convey his meaning, not yet clear to himself, he conceives that though not in this house or town, yet in some other house or town is the wise master who can put him in possession of the rules and instruments to execute his will. Happy this child with a bias, with a thought which entrances him, leads him, now into deserts, now into cities, the fool of an idea. Let him follow it in good and evil report, in good or in bad company. It will justify itself; it will lead him at last into that illustrious society of the lovers of truth.

"Cannot we let people be themselves and enjoy life in their own way? You are trying to make that man another you. One's enough.

"Or we sacrifice the genius of the pupil, the unknown possibilities of his nature, to a weak and safe uniformity as the Turks whitewash the costly mosaics of ancient art which the Greeks left on their temple walls. Rather let us have men whose manhood is only the continuation of their boyhood, natural character still: such are able and fertile for heroic action; and not that sad spectacle with which we are too familiar, educated eyes in uneducated bodies.

"I like boys, the masters of the playground and the street -- boys who have the same liberal ticket of admission to all shops, factories, armories, town-meetings, caucuses, mobs, target-shootings as flies have; quite unsuspected, coming in as naturally as the janitor -- known to have no money in their pockets, and themselves not suspecting the value of this poverty; putting nobody on his guard, but seeing the inside of the show -- hearing all the sides. There are no secrets from them, they know everything that befalls in the fire company, the merits of every engine and of every man at the brakes, how to work it, and are swift to try their hand on every part; so, too, the merits of every locomotive on the rails, and will coax the engineers to let them ride with him and pull the handles when it goes into the engine-house. They are there only for fun, and not knowing that they are at school, in the court-house, or the cattle show quite as much and more than they were, an hour ago, in the arithmetic class.

"They know truth from counterfeit as quick as the chemist does. They detect weakness in your eye and behaviour a week before you open your mouth, and have given you the benefit of their opinion quick as a wink. They make no mistakes, have no pedantry, but entire belief in experience."

It is just that experience, individual and social, which the Dalton Laboratory Plan aspires to provide within the school walls. The principles outlined in Emerson's picturesque prose are its principles. It shows the way, and I firmly believe the only way, to make school as attractive, and as educative as play, and ultimately to create those fearless human beings which, understood in the widest sense, is our ideal.

But as liberty is an integral part of that ideal I have carefully guarded against the temptation to make my plan a stereotyped cast-iron thing ready to fit any school anywhere. So long as the principle that animates it is preserved, it can be modified in practice in accordance with the circumstances of the school and the judgment of the staff. For this reason I refrain from dogmatizing on what subjects should be included in the curriculum, or by what standards the achievement of pupils should be measured. Above all, I do not want to canalize the life-blood of citizenship. On this point I can but say that the curriculum of any school should vary according to the needs of the pupils, and even in schools where it is designed to serve a definite academic purpose, this aspect should not be lost sight of as it often is. Until the educational world wakes to the fact that curriculum is not the chief problem of society, we shall, I fear, continue to handicap our youth by viewing it through the wrong end of the telescope.

To-day we think too much of curricula and too little about the boys and girls. The Dalton Plan is not a panacea for academic ailments. It is a plan through which the teacher can get at the problem of child psychology and the pupil at the problem of learning. It diagnoses school situations in terms of boys and girls. Subject difficulties concern students, not teachers. The curriculum is but our technique, a means to an end. The instrument to be played upon is the boy or girl.

Under the conditions that exist in the average school the energies of these boys and girls cannot flow freely. The top-heavy organization has been built up for the instructor, and with it teachers are expected to solve their problems. But I contend that the real problem of education is not a teacher 's but a pupil 's problem. All the difficulties that harass the teacher are created by the unsolved difficulties of the pupils. When the latter disappear the former will vanish also, but not before the school organization and its attendant machinery has been re-made for the pupil, who is rendered inefficient and irritable by being compelled to use a mechanism that is not his own.

The first thing, therefore, is to remove all impediments that prevent the pupil from getting at his problem. Only he knows what his real difficulties are, and unless he becomes skilled in dispersing them he will become skilled in concealing them. Hitherto our educational system has been content to tap the surface water of his energy. Now we must try to reach and release the deep well of his natural powers. In doing so we shall assist and encourage the expression of his life-force and harness it to the work of education. This is not to be achieved by doing the pupil's work for him, but by making it possible for him to do his own work. Harmony between teacher and pupil is essential if we would avoid those emotional conflicts which are the most distracting among the ills the old type of school is heir to.

Experience of the Dalton Laboratory Plan shows, moreover, that it is beneficial to the pupils morally as well as mentally. Where it is put into operation conflicts cease, disorder disappears. The resistance generated in the child by the old inelastic machinery to the process of learning is transformed into acquiescence, and then into interest and industry as soon as he is released to carry out the educational programme in his own way. Freedom and responsibility together perform the miracle.

Briefly summarized, the aim of the Dalton Plan is a synthetic aim. It suggests a simple and economic way by means of which the school as a whole can function as a community. The conditions under which the pupils live and work are the chief factors of their environment, and a favourable environment is one which provides opportunities for spiritual as well as mental growth. It is the social experience accompanying the tasks, not the tasks themselves, which stimulates and furthers both these kinds of growth. Thus the Dalton Plan lays emphasis upon the importance of the child's living while he does his work, and the manner in which he acts as a member of society, rather than upon the subjects of his curriculum. It is the sum total of these twin experiences which determines his character and his knowledge.

As illustrating this line of thought I cannot do better than cite a passage from Miss Emily Wilson's book entitled *An Experiment in Synthetic Education*. It is a little book which contains a big message.

"The main subjects of our curriculum must be taught synthetically -- that is, in their relation to each other -- and not in self-contained compartments. Only in the synthetic way, only by realizing and constantly emphasizing that to know something of Man we must study and correlate his History, his environment, his Science, Literature and Art, can we make knowledge a living and fruitful organism rather than a dead and barren file....

"It is necessary to emphasize a fact not sufficiently appreciated; it is easier to learn at the same time two subjects that have living relationships with one another than to learn one subject which is represented as an isolated fact having no vital relationship with anything else. Pure memory work is difficult and a burden to the mind. The moment the annual examinations are over we forget, never to recall, those unrelated facts with which we crammed our youthful brains. But once a relation is established as between one subject and another, both those subjects in so far as they are alive, that is are related, are retained with perfect ease....

"That this consciousness of the inter-relation of all subjects cannot fail to bear good fruit in the field of ethics and religion will be obvious. For service and co-operation are what we need to solve our great political and social problems today, and synthetic education that will provide that large and comprehensive outlook which will make these virtues a habit of thought and a practice of life. Some such total vision must be constantly in the mind of the teacher, who must ever be on the lookout for inter-relations and so stir within the minds of the children the faculty of creating channels between the different territories; channels which will fertilize the whole earth between them and give that infinite joy which comes from the consciousness of creatorship, the true function of man, the work for which he was endowed with an immortal spirit."

From the parent's point of view the principles of the Dalton Plan are admirably epitomized in a letter recently contributed to the *New York Evening Post* by the parent of two pupils attending the Children's University School.

To the Editor of the *New York Evening Post*:

> The Dalton Laboratory Plan is a decided novelty. Its adoption in England before we New Yorkers even heard about it shows how much more popular is the subject of education over there than here.
>
> As a parent of two children I wish to urge a more widespread acquaintance with the methods worked out in the Dalton Plan. It diagnoses the child's dislike for his studies as not due to the studies themselves, but to the methods used in teaching him. It does not start out with the belief that the child has an innate dislike for study. It is the fault of the educational process to which he is forced to submit which embitters his young soul against any or all subjects indiscriminately. The Dalton Plan is not an arbitrary process imposed on the child without regard to his aptitude, but is an enlistment of the child's own interest in his acquisition of knowledge. The Dalton Plan elicits a new response from the child's nature by inviting him to undertake the job in a way that appeals to his natural desire to learn things in his own way and even in his own time. The teacher gives *him* the same friendly help and encouragement to master his problems that one adult would give to another in the course of business or any undertaking of life, but the child is embarked on an adventure into the realms of knowledge with his own standard flying at the peak and his own command of his resources.

There is such a thing as culture. We treasure it as the embodiment of our civilization and we know that the stability of our social life depends upon the majority of our young people getting at least the elements of that culture. The Dalton Plan points a way to make the process natural and spontaneous rather than forced and arbitrary. It evokes in the child a spirit of self-reliance and initiative and so starts his character building at once. Here is life experience for the little fellow. He studies on his own responsibility in the company of his fellows, all pursuing the same adventure. He forms the same kind of relationships in his school life that he will afterwards get in his business or professional life. He is learning by trying. He is not struggling under constant direction and restraint. He is part of the real life of the world, sharing its problems, realizing the emptiness of idleness, and enjoying the rewards of industry. There is nothing false or artificial in these relationships. But, most important of all, the Dalton Plan starts him out on this basis full ten or fifteen years ahead of the boy or girl who is now going through the treadmill of our day schools.

* * *

Building the Schools of Tomorrow:
The New Laboratory for Teaching and Learning at The Dalton School

The New Laboratory for Teaching and Learning was established at The Dalton School in 1990 to explore and develop the technologies and techniques that will most effectively prepare students for the 21st century. An outgrowth of Dalton's historical commitment to experimentation and reform, and of the School's efforts to maintain a healthy evolution of its own programs, the New Laboratory provides a vehicle for Dalton faculty and students to pursue innovative strategies for teaching and learning through an array of collaborative projects. Together with universities, museums, corporations, and other schools, the New Laboratory's goal is to pioneer successful prototypes for change from which more widespread educational reform can begin.

New Laboratory projects join Dalton's tradition of student centered learning with the potentialities of the electronic world. They focus on two main areas: new techniques for teaching and learning science and mathematics, and classroom applications of existing and emerging technologies. In both areas the New Laboratory seeks ways for students to have as much direct experience of the world as possible, teaching them to approach the world as archaeologists, mathematicians, ecologists, astronomers, historians, and the like.

The Phyllis and Robert Tishman Project in Technology and Education is the keystone of Dalton's New Laboratory. Developed in conjunction with the Institute for Learning Technologies at Teachers College, Columbia University, the Tishman Project will explore how computers and advanced information technologies can help us build the schools of tomorrow. Teachers and technologists working together will design and implement a technology-intensive educational system based on a new concept, the Cumulative Curriculum. Breaking through barriers created by five centuries of dependence on the printed text, the Cumulative Curriculum grasps the pedagogical opportunities afforded by the communications revolution, and presages a transformation of teaching and learning as we have known it.

At the heart of the Cumulative Curriculum is the notion that a multimedia library network -- video, text, audio and graphics -- can now provide every student with general, efficient and enduring access to comprehensive, integrated materials. Rather than sequentially passing from-subject to-subject, grade to grade, students learn to construct their understanding of a subject, working cumulatively as scholars do. Dr. Frank A. Moretti, Director of the New Laboratory, describes it this way:

> We seek to replace the superficial traveler through the sequential school, who collects knowledge trinkets to memorialize each stop on the cultural itinerary, with the philosophical explorer, whose very search for knowledge is a search for self and community.

The multimedia network poses problems and provides access to intellectual tools and resources useful in solving those problems. Teachers facilitate and collaborate in their students' inquiries, as both learn to navigate a more complex and inclusive world of knowledge and experience. Dr. Moretti continues that, "The word cumulative points to the growing personhood of the child. As the Latin indicates, it is a 'heaping up' within." In the fullest spirit of the Dalton Plan, students are ultimately responsible for their own learning.

At present, the effort to develop a Cumulative Curriculum consists of a series of interactive simulations as well as explorations of the pedagogy of using powerful networked computer tools in the classroom, all in the context of a multimedia library accessible to everyone at all times. Among others, these projects include:

- *Archaeotype*, simulated archaeological excavations of both ancient and modern sites. This is an extension of physical simulations conducted in the early grades.
- *Ecotype*, simulated field research used to teach the earth and life sciences. This project also involves on-site research in the Black Rock Forest.
- *Playbill*, a hypermedia program developed for exploring dramatic and other performance art through a combination of

text, visualizations and critical literature.

- *Project Galileo*, a cross-platform integration of sky-simulation programs that provides an interactive laboratory for astronomical investigations.
- *Civil War Project*, a prototype of hypermedia resources used for studying American history. Multimedia tours and databases, developed by Dalton seniors, bring to life the experience of the Civil War in New York City.
- *Project Pythagoras*, a program that explores ways to use computer-based problem solving tools to focus on mathematical concept formation.
- *Pathways through the West: Vergil and His Influence*, an exploration of the classics of the Western tradition using hypermedia resources.

With the advent of digital technology, high-speed networks, and the decreasing costs of digital storage, the Cumulative Curriculum can create an educational environment free of the old constraints of time and space, where cooperation is a significant motivator and inquiry and learning have intrinsic value, where teaching is less routinized, and where the availability of broad-based resources will blur distinctions between disciplines and promote true multi-culturalism.

In 1991, the Cumulative Curriculum Project received a two million dollar gift from the Phyllis and Robert Tishman Family Fund. Additional support has been provided by: IBM, Curriculum Concepts, Inc.; DIXA; the National Aeronautic and Space Administration; and the Simon Foundation. Academic, corporate, and public interest groups actively participate in various projects, among them: Columbia University; Cornell University; M.I.T.; R.P.I.; the Universities of Georgia, North Carolina, and Pennsylvania; IBM Research; NYNEX Science and Technology; and WNET/Channel 13.

A secondary thrust within the New Laboratory is provided by the I-CM (Investigation-Colloquium Method) Project for Science and Mathematics and several smaller projects which promote experiential learning for young children. The Investigation-Colloquium

Method, in particular, distinguishes itself from similar "hands-on" approaches by emphasizing language development. Students investigate, observe, discover, and then discuss their findings, moving from concrete experience to abstract understanding and finally to practical application. Modifications of this approach are used in Dalton's third grade Archaeology Project and in components of the Visual Literacy Project.

An important aspect of the I-CM Project has been the dissemination of the method through summer teacher-training institutes held at The Dalton School and other locations since 1986. A special academic camp component provides a laboratory school for "hands-on" teacher-training, as well as supplemental learning opportunities for disadvantaged public school children from cooperating New York City school districts. In this way, the I-CM Project has provided the New Laboratory with a useful model for disseminating the fruits of its research and development. And finally, reflecting the technological focus of the Tishman Project, the I-CM Project anticipates a new dimension which will include computer-based, multimedia applications.

The I-CM Project was developed in collaboration with New York University and with the cooperation of the New York City Board of Education. It has received generous support from the DeWitt Wallace-Reader's Digest Fund, the Fan Fox and Leslie R. Samuels Foundation, the Altman Foundation, the New York State Department of Education and the U.S. Department of Education.

Work pioneered in the New Laboratory by Dalton's superior academic and technical personnel, through collaboration with educational researchers and practitioners from preeminent institutions across the country, has already begun to change learning environments at schools throughout New York City and elsewhere whose teachers and administrators have come to Dalton to be trained. As Dr. Moretti so aptly states, "The New Laboratory makes us focus on how and what we teach, and helps keep Dalton at the forefront of American education." He adds that, "We seek to imagine what the schools of tomorrow will be, and to begin building them today."

Co-Directors of the Tishman Project:

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Robert McClintock, Director, The Institute for Learning Technologies, Teachers College, Columbia University

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2) Project Evaluations

It is unusual, in the first year of development projects, to have external evaluations of results. Yet if we are to risk innovation in a successful school, it is essential to do so. As we implement programs in the classroom, we need to initiate their evaluation, to ensure from the outset that they are worthy components of a Dalton education, meeting the school's established standards and contributing appropriate increments to each child's development.

In our first year, four specific projects have reached the classroom -- *Project Galileo*, an eleventh and twelfth grade astronomy elective; *Archaeotype*, a substantial component of sixth grade social studies work; *Playbill*, a unit in the tenth grade literature course; and the *Civil War Project*, an eleventh and twelfth grade history elective. We present here the formal evaluations of these. Each major project evaluation consists of a report by an outside evaluator with established credentials in the field of study. We preface these with some general observations.

Of the four projects, only *Playbill* suffered at all (and only occasionally) in comparison to more traditional pedagogy. Criticism of the *Civil War* course came from all sides, and was sometimes fairly intense, but the underlying assumption was that "this is the most exciting history course ever." It was criticism from the converted. As for *Galileo* and *Archaeotype*, the only substantial negatives came from the project developers themselves; that is, from artists ever unsatisfied with their own work. For an observer familiar with the developmental history of all four projects, the first general lesson is unsurprising, but important: the success of the projects was proportional to the amount of quality time and energy that New Lab staff, faculty and students were able to give to them in the classroom setting -- that is, in the laboratory as the Dalton Plan originally conceived it.

Thus, while software essential to *Playbill* was under development by the New Laboratory before the Tishman grant, actual classroom implementation began only in the spring of 1992 and was sandwiched into a six week period in what was otherwise a conventional Drama course. Both *Galileo* and *Civil War* experienced "shakeout" periods during which students and faculty adjusted to the demands of the new technology and to the teaching and learning expectations that went with it. *Playbill* was in shakeout mode for the duration. No wonder *Archaeotype* escaped that limitation this year: it has been used in the classroom for two years, and sixth graders, unlike their already regimented counterparts in High School, are still flexible enough to jump right into whatever activity presents itself. From the developmental point of view, the conclusion is obvious: the possibilities of *Playbill* -- and of the "notebook," a key new project which it foreshadows -- remain to be fully explored in the only setting that really counts, the classroom as laboratory. With that said, it is all the more striking to notice that, in spite of the difficulties, all three of the (technologically naive) teachers involved are committed to further development.

> Personal Note
>
> Of the four members of the Executive Committee for the Tishman Project, I have long held the most skeptical view of our enterprise. My orientation towards scholarship and teaching is deeply traditional. I believe colleagues and students must struggle with the great texts through extended conversation, face to face, day after day. I don't trust the new communications technology -- in fact, I am a bit suspicious of technology, period. But any careful reader of this evaluation package will realize why I have been forced to suspend my skepticism. Critical of particular applications I remain, but never before in my career have I seen such a variety of students brought to so intense a level of engagement in so many different subjects.
>
> Tom de Zengotita

The *Civil War* project may seem to violate the overall investment/success ratio rule, since it elicited a massive effort from all participants but took more criticism than *Archaeotype* or *Galileo*. But that impression evaporates when the aspirations of the Civil War course are understood. Of all the projects undertaken so far, it is most informed by the New Laboratory's long range vision of education in the 21st century. It is the least modular, the most open-ended, of all the projects. It was that visionary dimension which kept *Civil War* students coming to Dalton to work on their projects until the end of July.

A second general lesson can be drawn out for emphasis. The success of these projects establishes a claim which progressive educators since Rousseau have always made -- namely, that learning is doing and not memorizing. The hoary old issue in debates with proponents of traditional pedagogy simply goes by the board in the context of the new technology. No judge of these projects can reasonably say: "Yes, I can see the kids really love all this, but are they *learning* anything?" Dr. Joseph Hogan, evaluator of the highly factual and densely conceptual astronomy project, was unequivocal on this crucial point: ". . . the *Galileo* format is such that by seeing and doing the students are far more likely to recall nontrivial facts, and to appreciate and understand the concepts, than they would were the course given in the conventional format. There is no question about this."

A third general lesson goes to the heart of the matter, and can be stated as an overall conclusion. Compared to the traditional text-based classroom, the educational environment provided by the new technology is more intellectually stimulating more of the time to more people -- faculty and students. On one level, this comes as no surprise; multimedia grip human attention through all channels. But, on that level, the new technology appears to many to be more a danger than an opportunity. But any impartial reader of the documents to follow will quickly realize that the Tishman projects are not about audio-video buzz. This is *interactive* multi-media, and not only in the usual computer sense of the term, but in extended senses as well: interactive in the personal dynamic which is set in motion among students and teachers; interactive also with respect to other resources like museums, libraries, university professors, pictures, buildings -- and, yes, books too. The outside evaluators especially were impressed, even awed, to see the wealth of materials involved in these projects, quite apart from the technology. But these materials were not, so to speak, brought up to school in a giant truck and dumped onto the courses. The other resources were recruited by the intellectual and even moral imperatives that were built in to the projects themselves. What the technology allows and propels is a situation in which more people are driven to interact as learners with an enriched environment because they have ownership of those imperatives. The first premise of the New Dalton Plan is: education begins with and is sustained by compelling questions that arise spontaneously in settings which allow people to pursue them successfully. The overall conclusion, the fruit of a year's labor by many dedicated students, teachers, staffers, and administrators is quite simple: in the environment we are creating, that kind of education is more likely to happen.

* * *

Evaluation of *Project Galileo:* Professor Joseph S. Hogan

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Introduction

Over the last thirty years, as the exploration of space rapidly redefined the frontiers of astronomy, the teaching and learning of this discipline made the transition from a sleep-inducing experience to an enjoyable and even exciting adventure. Visual aids in an astronomy class were once limited to star charts, photographs of the sun and moon, and blurred portraits of Mars, Jupiter and Saturn, all obtained from the surface of the earth. With the wealth of data now available from lunar and planetary probes and earth-orbiting telescopes, the astronomy instructor has gained a decided advantage over narcolepsy. The tremendous increase in our knowledge of the extra-terrestrial universe is in part due to the acquisition of a huge collection of detailed images from spacecraft, including many striking views of previously unknown or poorly understood objects which lend themselves readily to classroom use. Most of these images (and other data) are now available at no or little cost to the astronomy instructor wishing to augment his/her arsenal and to stimulate her/his students. Yet for most students of introductory astronomy, the classroom experience remains largely passive. Activities are normally limited to evening observing sessions which are as often as not "rained or clouded out." The "Astronomy" course at Dalton is unusual in that the vast majority of secondary schools do not offer such a year long elective to their students. It is unique in that it involves the students actively in manipulation, analysis and interpretation of recently acquired data, in a sense repeating the work of the original experimenters. In my view, this goes a long way toward dispelling any lack of confidence on the part of the students in their ability to grasp science. They are not only learning science -- they are in a real sense participating in it. And they are not repeating time-worn turn-of-the-century experiments in chemistry or physics -- they are working close to the frontiers of a rapidly expanding body of knowledge.

The visit

I spent several hours at the Dalton School on Friday, May 8 (AM and PM) and on Monday May 11 (AM). After an orientation session with the instructor and a brief tour of the relevant facilities, I attended a series of laboratory discussion sessions of the "Astronomy" course. During these semi-formal sessions, as the various student teams were at work, I not only "looked over their shoulders" but injected myself as an adjunct team member to assess their understanding of the objectives of the experiment, their comprehension of the subject matter involved, and their rationale in drawing whatever conclusions were called for in the assignment. I later examined a dozen or so written reports which students had submitted, related to earlier portions of the course, along with some highly detailed written course material prepared by the instructor.

I had a lengthy discussion with the instructor about various features of the course at present and his plans for further development. I was given an impressive series of computer demonstrations by the instructor which clearly demonstrated the power, flexibility and other features of the system (both hardware and software) in place. Unfortunately, a scheduled lecture was necessarily canceled due to the illness of the instructor, but in its place, arrangements were made for me to speak candidly with several of the students about their math and science backgrounds, their impressions and evaluations of the course, and the benefits they perceive the course bringing to them. My observations (as to how teaching and learning in the context of this project differs from teaching and learning in the traditional print-based setting) follow.

Use of classroom time and space

The room in which the computer terminals associated with this course are housed tends to induce claustrophobia, especially when a team (normally two students) is seated at each terminal and the instructor and perhaps the system manager are making their rounds from terminal to terminal as the students require assistance. The space in this room is totally utilized, and for any increase in the class or section size, a larger space must be sought. This is a widespread problem for institutional facilities which were designed in the "pre-computer" days (I took note of the antique demonstration slide rule in an adjacent room) or the days when few courses were "computer intensive." The students, however do not seem to mind the "close quarters" and work well in the available space.

The room in which the group discussions were held could also have been larger and/or the furnishings better arranged for use in this course. It is not well suited to small group discussions. With the groups clustered characteristically at the corners of lab tables at various points throughout the room, and with an array of computer and word processor work stations around the perimeter, it was extremely difficult for the instructor and myself to move from group to group as required. In fact we had to scale the lab tables at times to navigate from one group to another, without asking an entire group to move out of the way (which we chose not to do, as our extreme youth and agility allowed us literally to "table hop"). These small group sessions might be better held at a set of tables in a corner of the lunchroom if scheduling permits. Here again, the students do not appear to be adversely affected by this situation.

Classroom time was fully utilized from "bell to bell." The teams and groups of students were given detailed assignments which they had to complete by the end of class. These tasks were carefully planned so that they could be accomplished within the allotted time, but to do so the students had to work busily for the entire period. In almost all cases the students completed the assignment close to the end of the period; those who did not were allowed to submit it later (on the same day, if I recall correctly).

Student-student interaction

The way in which astronomy is taught within the context of *Project Galileo* requires teamwork and fosters friendship. Interaction between students is a stated part of the assignments, and students must work together to complete group projects and team tasks; everyone is drawn in and no one can opt for isolation. Individual opinions are exchanged, gentle criticism, argument and tests of logic follow, and compromises are struck between individuals as the group or team formulates and packages its "product," always under the watchful eye and guidance of the teacher. (See *Student-teacher interaction* below.) Ordinarily, the conventional, print-based astronomy format involves little or no collaboration between students, and many institutions would prohibit it. Both the conventional format and the *Galileo* format have the important and usual objective of conveying an understanding of the subject matter to the individual student. *Galileo*, however, has a second important objective: the broader educational benefits which can be derived from the new technology *and enhanced student-student interaction*. This second goal does not diminish success in meeting the first. *Project Galileo* is achieving both of these objectives superlatively.

Certainly, student personalities tend to define leadership roles within groups, but only a few of these were obvious to me. Collegiality was the rule; in no instance did a student dominate the discussion or dictate to the others what the outcome of the assignment would be. I witnessed no competition between or within teams or groups to win the teacher's favor. On the contrary, students continuously helped each other at the key boards of the computers and word processors and with the composition (phraseology, spelling, punctuation) of the in-class project reports, using the instructor as a "backstop" and "sounding board."

Project Galileo and the conventional astronomy format have the same basis: presentation of the subject matter by the instructor, supplemented by the textbook and various other written, graphical and visual materials. But the topics of astronomy become more attractive, interesting and easier to comprehend in the context of *Galileo*. *More important*: via the group interactions associated with *Galileo*, the students learn many things from each other which they will find extremely useful in areas far from the field of astronomy. With *Galileo*, they improve their writing and debating skills, increase their computer-literacy and cultivate logical (scientific) thought processes. *Most important*: from the give-and-take associated with the team and group projects inherent in *Galileo*, they learn how to interact, collaborate and compromise with others in the spirit of détente. Enhancement of their interpersonal skills constitutes a lifelong benefit.

Student-teacher interaction

The astronomy course within the context of *Project Galileo* necessitates a close interaction between students and teacher in the small discussion groups and computer laboratory sessions. (Normally, at the college-level, these components of the course would be conducted by teaching assistants and/or lab technicians, precluding student interaction with the principal instructor.) The presence of the teacher in all segments and sessions of the course provides a constant, authoritative and unequivocal resource for the students, including guidance in discussions, instant response to questions, and rapid assistance when problems arise at the computer and word processor terminal. Thus, the students never find themselves idling in a situation in which they simply don't know how to proceed, and progress is maintained.

The rapport of the instructor with the students is excellent. He maintains a firm but gentle hand on the class, and exudes an enthusiasm for the subject which is "catching." (See *Teacher Commitment* below.) His students clearly respect him, yet they enter his classroom as if they were visiting a friend, especially in the less formal small group and lab sessions which are ordained by *Galileo*. The instructor is a cheerful, patient individual and an expert at the use of humor in holding the attention of the students. The students seem to regard him as a caring older brother to whom they can easily relate; he in turn, with his personality and understanding of the teenager, easily relates to them. They admire him as a reservoir of knowledge in a relatively exotic, "far-out," "awesome," rapidly expanding field which is rather poorly understood by the average citizen.

Effect of (and on) gender bias

Science and technology have always been male-dominated and the field of astronomy is no exception. In a long overdue break with tradition, increasing numbers of females are opting for scientific and technical careers and they are making significant contributions to the expanding body of knowledge in all fields. To insure that every citizen receives a broad secondary education irrespective of sex or of the career path chosen, the same general course requirements are applied to all students. However, as far as elective courses are concerned, especially in the sciences, the typical choices of male and female students will be somewhat different.

After many years (in higher education) teaching courses at all levels of technicality in many subjects (including astronomy), monitoring enrollments and observing trends, I would wager heavily that the percentage of female students in the "descriptive" Astronomy course at Dalton is greater than the percentage of females in the "qualitative/quantitative" Physics course, which is in turn greater than the percentage of females in the "quantitative" Physics A course (descriptors taken from the Dalton High School Catalogue). Such a pattern is the predictable result of the somewhat different roles which males and females play, or are convinced that they should play, in our society. I leave it to others to decide whether a deliberate attempt should be made to break the existing pattern, or whether a gradual transformation to another pattern should be allowed to take place as changes in societal attitudes continue. While I do not know the actual male vs. female enrollments for any of the above courses or for the Institution as a whole, there were more females than males present at the sessions of the astronomy course which I attended.

I detected no difference by sex in student attitudes, degree of involvement, treatment by the instructor, or in the quality of logic in interpreting observations or results of experiments. While all of the individual student reports which I read were of high quality (see *Student work* below), I believe that those authored by female students were somewhat superior both in content and in composition and somewhat more carefully prepared than those authored by male students.

Some students undoubtedly began this course with more prior experience than others in the use of computers and word processors, and it may well be that the females on the average had less experience than the males. However, since *Galileo* requires extensive use of these devices on a day-to-day basis, even those students who approached the terminals with apprehension last September should have, by the time of my visit in May, long since overcome their awe of the "beast" and felt comfortable and in control at the keyboard. This familiarization over time has surely taken place in both sexes.

I detect no difference in male vs. female rapport with the computer and word processor, nor in male vs. female success in using this equipment to accomplish the assigned objectives. On the one hand, I was unable to identify any true experts with these devices; on the other, I did not observe a single student who was lost "at sea" -- male or female.

A conventional astronomy course calling for little or no interaction with computers and wordprocessors would do little to allay student apprehension about the use of these devices, let alone hone student skills (as does *Galileo*). If females are initially less confident than males as they interact with the computer, they will learn as the course progresses that the males do not have superior abilities in the use of this device.

Classroom atmosphere and attitudes

The atmosphere in the classroom was invigorating and collegial. The group sessions which I attended were semiformal but well controlled. I was told by both the teacher and the students whom I interviewed that the lecture sessions are formal, as is appropriate, but also cordial. The students were wide-awake and seemed excited by the challenges that the tasks presented. The attitude of the students toward the teacher was one of respect and admiration. The attitude of the teacher toward the students was caring, understanding and encouraging. It became clear that there is a bond of friendship between the class and the teacher. The teacher knows the individual personalities of his students very well; he pokes fun at some, is more serious with others, etc., but always the students see a smile on his face. The attitude of the students toward the subject was quite positive and enthusiastic. All of the students whom I interviewed said that they felt they were learning the material quite well; all said that they found the course enjoyable, and all said that they were happy that they had chosen it. (See *Student-student interaction* and *Student-teacher interaction* above. See *Teacher commitment* below.)

Amount and quality of work done outside of class

In its present format, each two week (or so) segment of the course requires several hours of work outside of class. Since the assignments for each segment include a substantial written report, to be submitted on a specific date, it is fairly easy for the instructor to determine if a student is spending enough time on the subject. To construct the report, the student must ponder the material contained in class notes and textbook, reconcile his/her own calculations with those obtained by others and discussed in class, draw logical conclusions and offer reasonable explanations, draft the report, and (in most cases) extract the final product from the word processor or typewriter. The sample reports which I read were all of high quality (better than most submitted to me in science courses at the University level), which indicates that the amount of effort expended by the students outside of class is considerable but not so overwhelming as to produce a negative attitude toward the course, subject or instructor. It seems to me that a conventionally taught astronomy course should require approximately the same amount of out-of-class effort, but normally the out-of-class work would involve only reading and writing, since experimental analysis and interpretation is not involved. (See *Student work* below.)

Individual energy, focus and initiative

In my opinion, the students in the *Galileo* astronomy course are highly interested and consequently, highly motivated, relative to those taking print-based astronomy courses. (See *Student work* below.) The result of this is that they all work harder without pain and without realizing it. This translates into a high level of energy relative to the course and a much sharper focus. These days, few students in a conventional astronomy course (or any other conventionally taught course) would venture a "Guess what we *learned* today?" at the evening meal. In *Galileo*, I would imagine that a "Guess what we *did* today?" is a likely topic over dinner.

While I am sure that this does not apply to all students in the class, I am told by this instructor (confirmed by my student interviews) that many students become interested enough in some aspect of the subject to perform research projects outside of the class, which they pursue on their own *initiative* with the instructor as an advisor and resource. (See *Student work* below.) The likelihood of such an occurrence in a conventionally taught astronomy course both at the high school and university level is quite small; and that it is a common phenomenon in the *Galileo* context speaks well for the Project and the instructor. High marks for energy, focus and initiative!

References to past and future activities and to resources beyond the classroom

Throughout the sessions which I attended, the instructor (and the students) made frequent references to previous activities and results as well as to things to come. It was clear that an unbroken thread extends throughout the course.

For each segment of the course a detailed multi-page assignment is distributed to the class, outlining each task to be carried out by the students, and providing them with a great deal of background information. Included in this document is a list of resources which the students must, can and ought to use both in and outside class. Thus, the students are clearly informed about what they must do, and are told how to proceed and where they may find help. Approximately one half of the list of resources derive from or are used in close conjunction with *Project Galileo*. The remainder are the conventional -- the textbook and other written documents, projected visual displays and, of course, the instructor himself -- which would necessarily be used in the pre-*Galileo* mode of presentation.

Student "ownership"

While there were a number of instances in which the instructor was called upon for assistance, all students approached the computers and wordprocessors with a high degree of confidence. In the two-person team sessions, it was (of course) only possible for one student to operate the keyboard, but in every case his/her partner seemed as conversant with the system as the operator. It is reasonable to assume that the close interaction with the technology required by *Project Galileo* has significantly enhanced the level of confidence of the students in dealing with these systems and in their ability to use these systems to achieve a desired result. (See *Effects of (and on) gender bias* above.)

Teacher commitment

The instructor is clearly dedicated and a master of the art of teaching young people. (See *Student-teacher interaction* above.) He seems to take delight in passing his uncommon factual knowledge and understanding of the way in which the universe works along to others. His curiosity about and awe of nature on the grand scale of astronomy are both obvious and contagious; his students seem to have developed a similar sense of inquisitiveness and fascination. The ability to instill such enthusiasm for a subject in one's students is the mark of a true teacher.

The instructor makes a point of elucidating each process and phenomenon by using as many examples and analogies as required to reach every single student in the class. As the "light bulbs" begin to "light up" around the room, the instructor's sense of satisfaction with his ability to communicate becomes noticeable to the astute observer.

I note from examining several graded and heavily annotated reports from individual students, that they are read not only for factual content and logic, but also for form, grammatical construction and spelling. Thus the instructor is not only testing for depth of exploration and comprehension of the subject; through criticism and editing, he is exhorting his students to reach for perfection in expression and showing them how to achieve it. Such thorough, friendly criticism constitutes time-consuming homework for the teacher who is clearly striving to "educate" his students in the most general sense and not only in the subject of astronomy.

Student work

In the *Galileo* mode, the astronomy course fosters both teamwork and independent critical thought. The logic of the students is constantly challenged by the instructor and their classmates, but always in a friendly and gentle manner. They question and criticize each other and learn to argue for their viewpoints as well as listen to the opposing view. Being required to do this from the start of the course, they have lost their fear of asking a "foolish" question or expressing a "silly" viewpoint and "looking stupid" to their classmates. In the conventional format, there would be little opportunity for these exchanges and little chance for a retiring student to overcome his/her verbal insecurity. Thus the interpersonal skills of the students are honed by *Galileo*. (See *Student-student interaction* above.)

Also, with *Galileo*, the subject is made more attractive. As a result, the students are far more likely to become "hooked" on a particular topic or phenomenon and to pursue it in greater depth or along different lines than called for in the assignments. They can easily do this under the guidance of the ready and willing instructor with the enormous resources provided by *Galileo* at their fingertips. This opportunity to do "real" research beyond the conventional "go to the library and read about it" concept, would not exist without *Galileo*. Most of the research, of course, has already been done by the professional scientific community, but I am informed that some student enterprises may have actually broken new ground. Certainly the possibility of discovering something new exists; the students know this and are excited by the possibility which tempts them to try their hands at it and get involved. (See *Individual energy, focus and initiative* above.)

Galileo has produced an extremely well-organized course with modules and assignments which are highly detailed but very clearly explained to the class in written form. The forward pressure is continuously maintained by the instructor and at no point are the students allowed to coast. Completion of the assignments requires coordination and organization by the students and the various bi-weekly project reports are exercises in organization among other things. For a team to produce a result within fifty minutes or so organization is a necessity, and I submit that the sharpening of the organizational skills of the-student is a major spin-off of *Project Galileo*.

It is clear to me from the quality of the individual reports which I examined that the students entered this course with superior writing skills. (I commend the Dalton School on its success in teaching its students to express themselves clearly and correctly in writing. I find it comforting to know that there is at least one secondary institution which has adopted an entirely modern approach to education while holding steadfastly to the conventional belief in the value of the three "R's.") To what degree the *general writing* abilities of the students are enhanced by *Galileo* vs. the conventional format is unclear, as any writing-intensive course will produce improvement. However, the *technical writing* abilities of the students will certainly have improved more with *Galileo* than with the conventional format. For example, with *Galileo*, the students must describe and analyze the results of their own work which includes detailed calculations, etc.. Their reports must therefore be more technical than the reports one would expect in the conventional format which would tend to be more poetic in the mode of most modern textbooks, encyclopedia and newspaper articles, etc.. (See *Amount and quality of work done outside of class* and *Teacher commitment* above.)

Subject matter -- levels of factual and conceptual control

The nature of the course in the *Galileo* format is such that by *seeing and doing* the students are far more likely to recall non-trivial facts, and to appreciate and understand the concepts, than they would were the course given in the conventional format. There is no question about this. As part of my interviews, I specifically asked the students to describe what they had learned about a topic (Cosmology) presented much earlier in the course, and I gently tested their comprehension of this subject (which is relatively difficult for most people to comprehend). While no student in the group I met is likely to complete the work of Einstein, their recollection and comprehension of the state of cosmological affairs was much better than I anticipated based on my own experience lecturing and testing on this subject. Students are much less likely to be in "control" of facts and concepts when they are allowed to "coast" or to "vegetate." Their intensive, almost "hands-on," involvement with the subject through *Galileo* has clearly produced an enhanced level of control.

A further indication of this enhancement of control lies in the following episode: in one laboratory session (exercise) which I observed the instructor provided the students with basic data on the four largest satellites of Jupiter, including the sizes of these objects.

The students were asked to input this information to the computer, calculate other properties of the satellites from those given, and display the results in spreadsheet form. One subset of the data supplied was incorrect (too large by a factor of 2): diameters rather than radii had been supplied by the (wily) instructor. As a result the calculated densities of the satellites were uniformly low (by a factor of 8 !) indicating that all of these bodies were lighter than water, and indeed that all were lighter than Jupiter itself. As the results appeared on the screen, the students were quick to notice the anomaly, to sense that its implications were unreasonable, and to conclude that some component of the data provided was erroneous. The instructor (of course) was quick to pinpoint the "error," and (with a wink in my direction) inform the students how to compensate for it. The point was made, however: the students were tested and they passed with flying colors.

Thus, the students' general awareness of planetary relationships, their intellectual reflexes, and their recall of previously learned facts and previous calculations of their own, are all very strong. They were well aware that the smaller objects in the solar system are by and large more dense than the larger bodies, they remembered and understood the basic relationships between mass, radius, and density, they were able to recognize an unusual result immediately, and to speculate what its consequences would be were it "real," they have mastered both the concepts and the facts.

Many times during my own career as an instructor, I have deliberately thrown an outlandish "curve ball" at my students as a test of their reflexes, understanding and recall, and almost always I have been disappointed with the reaction -- or lack of reaction. I was surprised, delighted, and impressed to observe the reaction of the Dalton students to this test, and I can only conclude that the hands-on approach to the subject made possible by *Galileo* is responsible for their superior comprehension of the material.

Possibilities

The possibilities for the continued evolution of this course seem to be almost endless. The facilities provided by *Galileo* allow for the development of a huge assortment of interesting, intriguing and enjoyable exercises, not only with currently available information, but also with the information to be acquired as the exploration of space continues. The associated computer facilities are more than adequate for the foreseeable future, and hence the only limit for the years ahead is the imagination of the instructor. Knowing the instructor, this essentially means *no limit.*

Considering the other elements of the Cumulative Curriculum Project along with *Galileo*, it is clear to me that the collective result will be a significant improvement in the already fine education which the Dalton School provides. Students learn more when they are interested and curious and the various elements of the Cumulative Curriculum Project should all whet the student appetite for learning. Development of other projects within the framework of the Dalton curriculum will only be limited by scheduling, given the present size of the facility.

Recommendations and Speculations

To make recommendations on how to improve such a well-planned and well-running instructional machine would be worse than presumptuous on my part -- it would be foolish. The first time any course is offered successfully, careful planning and an enormous amount of time is involved; it is clear that the instructor and his associates have expended considerable and sufficient effort in this regard. The second time through a course is the time for implementing feedback, and tuning the various elements of the course as necessary. The instructor has informed me of certain elements (segments) of the course which he believes could stand some improvement and/or further development, as is usual (exhibiting a healthy and humble attitude on his part); I consider these to be small "bumps," and I am confident that appropriate minor adjustments will be made to eradicate them. The instructor will never be allowed to rest however, since the science of astronomy will never stagnate. The flow of new discoveries and new data will prompt continuous change and require sustained effort at revision in the years ahead. I speculate that requests for this course from Dalton's students will increase.

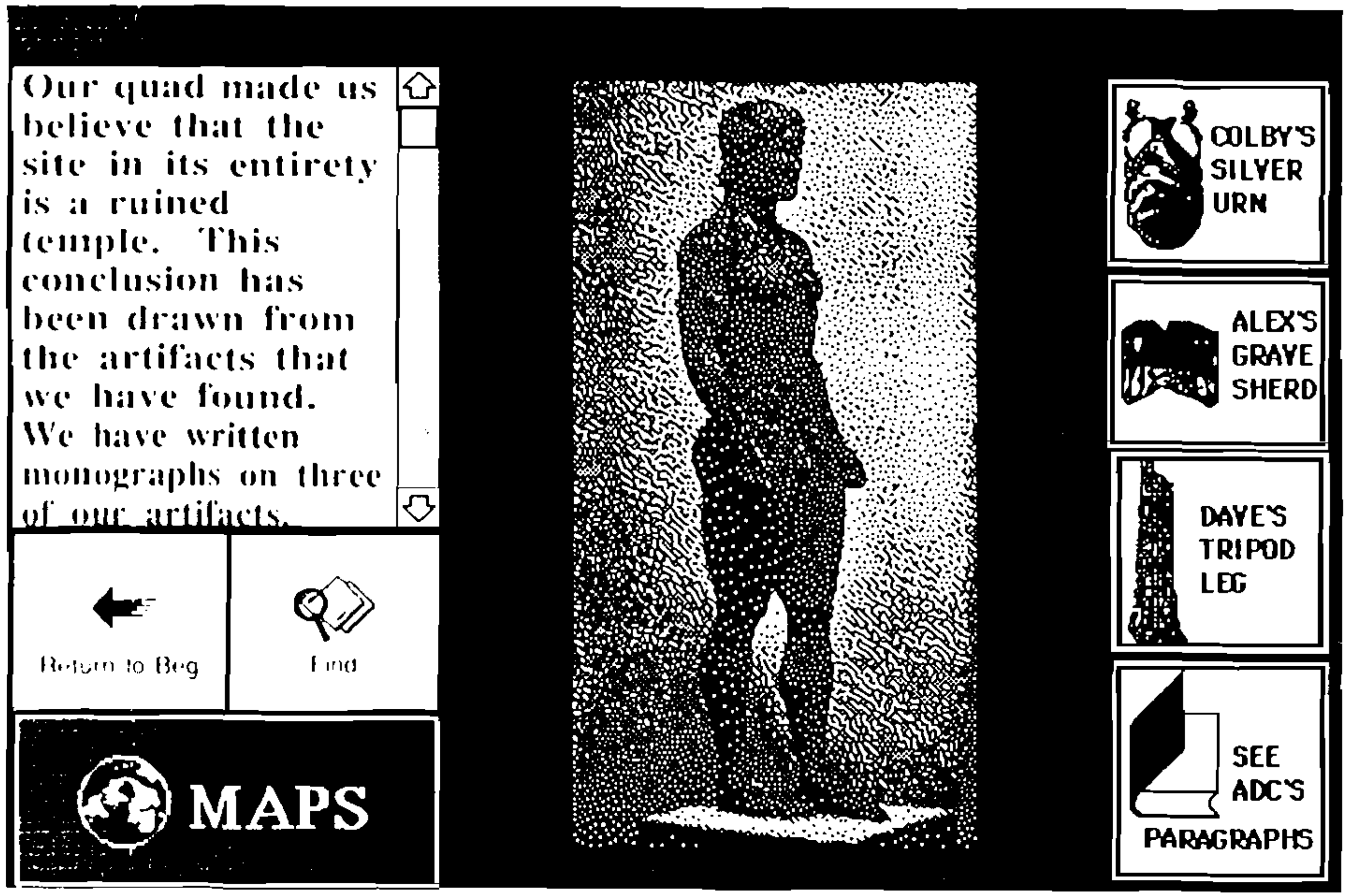
Summary

1) I thoroughly enjoyed my visit to the Dalton School. It was an educational experience for *me*.
2) I was very much impressed with the Dalton students. It is clear that the education they have received is an excellent one -- one which many more future leaders of our society should have.
3) I was very much impressed with the astronomy course in the *Galileo* format and the numerous benefits that the students are deriving from it, although I am sure that the course in the conventional format was as fine a one as permitted by the prior limitations.
4) I was very much impressed by the instructor in action his dedication to his work, his concern for his students, his knowledge of the subject and his lively imagination.
5) I was very much impressed with new technology in place, the use being made of it, and the possibilities for the future. Although a scientist and a science educator by trade, I am not too proud to admit that I was *astounded* to see such a system in operation with great success in a high school environment.
6) I was very much impressed by the concept of the Cumulative Curriculum Project and, in particular, the *Galileo* concept. The experiment, in my opinion, has been completed and it is highly successful at achieving its goals.
7) Overall rating of *Project Galileo*:

Concept	EXCELLENT!
Implementation	EXCELLENT!
Results	EXCELLENT!
Benefit to Students	EXCELLENT!

8) Final Comment: CONGRATULATIONS!

* * *


Our quad made us believe that the site in its entirety is a ruined temple. This conclusion has been drawn from the artifacts that we have found. We have written monographs on three of our artifacts.
Return to Beg
Find
MAPS
COLBY'S SILVER URN
ALEX'S GRAVE SHERD
DAVE'S TRIPOD LEG
SEE ADC'S PARAGRAPHS

Evaluation of *Archaeotype*: Professor Mark Petrini

Department of Classics
Columbia University

During the space of two days I observed classes at the Dalton School which use the *Archaeotype* program, a project within the New Laboratory for Teaching and Learning. My goal was to evaluate the program as a tool for introducing sixth and seventh grade students to the history and culture of ancient Greece and (though, at present, to a lesser extent) of ancient Rome. I was able to observe two classes and two group discussion periods; I also interviewed students, teachers, librarians, project managers, and administrators; I reviewed the collection of classics texts in the Middle School and High School library; and I observed students during free periods in the computing center. I returned to Dalton for two afternoons after classes had ended to evaluate the final results of the *Archaeotype* projects I had seen in progress. My total time spent observing and interviewing was about fourteen hours.

This evaluation will specifically address the following issues:

1) **Project overview**
   - A) Computers and Print-Based Learning
   - B) Computers vs. Print-Based Learning
2) **Students in the Classroom**
   - A) Student/Student and Student/Teacher Interaction
   - B) Gender Issues
3) **Comparison of *Archaeotype* Projects and Traditional Class Work**
4) **Some Possibilities and Recommendations**
   - A) Expansions
   - B) Staffing
   - C) The Reference Library
   - D) The Dalton Press?

1) Project Overview

The classes I observed were broken down into groups of three or four students.

Each group undertook the collective task of uncovering quadrants of an "archaeological field," a computer image of a fictional site containing "buried" artifacts from a six- or seven-hundred year span of Mediterranean history. Groups excavated small areas of their quadrant each day and evaluated the objects found there according to weight, color, and material; these data are provided by the program through simulated measuring devices. Students first take their objects (printed images) to the reference library for identification and dating: as each quadrant is excavated, the site is recreated on a "hard-copy" map with pictures of the objects in place.

The heart of the program then begins. With all the quadrants finished, the groups come together over the map and present their findings to rest of the class. Group by group, and then as a whole, the students form hypotheses about possible circumstances that might have produced the particular collection of vases, coins, armor, etc., that the site has yielded. The sites are fictional, but created by members of the faculty from real artifacts, and the students' hypotheses must be based on real historical events: the dates, places, and participants of the Persian and Peloponnesian wars, for example, must be accurately accounted for, and plausible explanations construed for the both condition of the finds (which might show evidence of burning, etc.) and for their presence in the site.

A. Computers and Print-Based Learning

This brief account of the program in action suggests a welcome and perhaps unexpected strength of *Archaeotype*: the relationship between the computer program and traditional primary and secondary texts. This is not a program which will replace or decrease the use of the library -- the opposite is certainly the case, and the book collection at Dalton is where the real work is done. Those who fear that the levels of computer-virtuosity I observed in these students threaten the written word need only spend an hour with this program. Much heavier library traffic is already a fact, and the increasing strain on library personnel and resources is a problem that will have to be dealt with (see below). I spent a number of hours going through the library holdings at Dalton, both in the junior high school library and the high-school library; I examined borrower-cards, spoke with students, and watched them work. The collection is well-used -- more broadly and deeply used, I would add, than the collections at some small colleges. By the end of their time with *Archaeotype* very young students have begun to learn the basic principles of research. It is an impressive strength of the program that it leads to an increase in the use of books, and that it provides a precise model of how any scholar uses an actual research collection. These students will have a tremendous advantage when they arrive at universities with these skills already well in hand.

B. Computers vs. Print-Based Learning

The difference between the *Archaeotype* classes and more traditional history and social studies programs is immediately striking. The conventional classroom experience, with students passively absorbing canonized information from lectures and texts, can indeed be valuable and stimulating, and will no doubt remain an indispensable part of secondary and university education; its limitations, however, are notorious and profound, particularly in the study of the ancient past. To create a continuous and coherent narrative, teachers of Greek and Roman culture at all levels are obliged to make uneasy compromises: suppositions and possibilities become facts; elaborate reconstructions of wars, individuals, and vast migrations, depend at times upon a few coins or the charred ruins of a temple. We all learn to accommodate the discoveries that every few years displace the intellectual cornerstones of the day and require varying degrees of re-writing history.

The *Archaeotype* program aggressively addresses this problem in the study of antiquity. The direction of learning is re-oriented: the primary "text" students confront in the classroom is the body of evidence itself, the artifacts which, as they are weighed, measured, and identified, slowly acquire significance, and only collectively acquire meaning. Students are never given an officially-sanctioned account of the site, and their answers are not right or wrong except as they relate to the strongest interpretation of the evidence; the prize goes to the most plausible conclusion, the hypothesis which most reasonably unites their discoveries with what they know about history. The key ingredients in this endeavor are information, imagination, and common sense.

The real work done in these classes, therefore, is synthetic thinking, a demand more often made only on students in upper-level university courses. It would be difficult to overstate my admiration for the results of the program and those who have brought it to life in the classroom. The sixth and seventh-grade students at Dalton have, first of all, learned an astonishing amount of information about the ancient world. Students know who fought in the Persian and Peloponnesian Wars, and why, and when; they know Themistocles and Pericles; they understand what ostraka are, and why they were used. I had a long discussion with one group about Archon-lists (!) They had found in their quadrant a fragment of stone engraved with the names of Archons and were in the process of creating short biographies of the characters. Most of us who instruct first-year university students scarcely flinch when bright undergraduates from good schools don't know that Greece "came before" Rome, that the Homeric poems are in Greek and the Aeneid in Latin, or that Athens in the fifth century was special. I was frankly stunned to hear sixth grade *Archaeotype* students at Dalton correcting each other in class on the dates and places of Greek history, and making detailed contrasts between the artifacts used in the fifth century and those used in Homeric times.

Students have acquired a well-developed sense of the intellectual, as well as the material, culture of the Greeks. They are thoroughly acquainted with the myths and legends of the Heroic Age; they understand which gods the Greeks worshipped, and what their chief attributes were. I was further impressed that students knew how these mythologies and theologies were practiced and applied: one group explained to me that myths of the Amazons were used in Athenian literature and art to reflect the Greeks' pride in their victory over Persia; other students made some interesting guesses about an engraving of Heracles and Apollo fighting over a tripod at Delphi. These are giant steps, in my opinion, for students so young to have taken: *Archaeotype* students have a solid elementary grasp of the sweep of Greek history and culture, and an impressively precise knowledge of the major events and historical milestones. Best of all, they have more than the handbook views and stock opinions so often imparted by traditional courses. Students are learning how to deal with cultural studies in three dimensions, and they have begun to understand what lies behind the two dimensional accounts of the past found in text-books.

I would like to add a further observation. When a culture and its people are treated as idealized and monolithic -- "the glory that was Greece, the grandeur that was Rome" -- the game is over before it begins. Few students will ever love or understand or be changed by these larger-than-life creations that seem to exist only on the shelves of a Great Books series. *Archaeotype* students instead absorb history and culture piece by piece, one stone at a time. They know the general facts that any teacher wants students to have learned, but they have gone beyond the mystique and venerability that obscures the true beauty and real greatness of antiquity. For these students, Homer, Pericles, and the Parthenon have ceased to be remote and inaccessible objects; they have human size and proportion, and have the potential to be sustaining presences in students' personal and intellectual development.

2) Students in the Classroom

A) Student/Student and Student/Teacher Interaction

There are many features of the *Archaeotype* approach to learning which I would hope to see incorporated into other courses and other programs: of all of them, the qualities of interaction between students, and between students and faculty, seem to me the most immediately profitable transplants.

Unlike the traditional classroom struggle between enforced silence and adolescent energy, the *Archaeotype* program demands conversation among students and between students and faculty. Learning is almost entirely collaborative; ideas and information are exchanged and compared from minute to minute, and students have their questions answered more or less as they arise. Best of all, the questions which emerge seem (as one would hope) to represent stages of actively evolving ideas to which instructors give shape and direction rather than pat answers.

There is an inevitable amount of unrelated conversation in the room, and I watched closely to judge the proportions of time spent working and of time spent being in the sixth grade. I am convinced that the time thinking and working with the *Archaeotype* is at least as productive and as valuable as the comparable hours spent in ordinary classes --I suspect that it is more productive. Students lose focus and re-focus, talk about both their work and their lives, just as any of us do while we work in teams.

It is further the case that classroom conversation seems directly related to the atmosphere which the project creates. Students are having fun, and they are enjoying the experience of working with each other. The sense of student ownership is unmistakable: students seem excited by the idea that these projects are their own creations, and that their energy, imagination, and initiative will be rewarded.

Finally, I was particularly impressed with the complementary specializations that had developed within groups. Students were conversant with all features of the program, I found, but some were unusually good with the technological side of the project, others with the details of the Persian wars; others could remember and compare artifacts from different projects or from different contexts (the visits to the antiquities collection at the Metropolitan Museum of Art seem to have been extremely useful and fruitfully absorbed). The exchange of these sub-specialties among students was a natural and effective component of the program which will no doubt continue to contribute to its success.

B) Gender Issues

The tendency of male students to dominate classes affects all of us who teach; few who have worked with this fact any longer believe that the problem, if left alone, will "sort itself out." It persists in undergraduate and graduate university classes and beyond, and it seems to require delicate and constant intervention. On its own, I cannot see that any technology, *Archaeotype* or another, will have much effect on this fact of life. It is due rather to the sensitivity and good judgment of the teachers in the classroom that *Archaeotype* has been made into a strategy for dealing with this issue.

Archaeotype teams were divided by gender, and groups of girls and boys worked separately for most of the project's early stages. The effectiveness of this decision was obvious. Girls are given the room they need and the attention they need in individual groups, without having to compete with their male colleagues. The problem of equal distribution of time and attention does not really arise until all the groups meet together as the excavation is completed. In that context it is a much simpler matter to keep the gender balances intact than it would be day to day throughout the project; faculty can (and did) use the larger groups to impress upon the students the necessity of patience and fairness.

I was impressed and surprised, finally, to see the way in which girls in the groups formed bonds, and how they learned to interact together and to work out problems. At one point during a discussion session a student felt that she was lagging behind her group-members, and worried that she was being excluded. The teacher took all four students into the hall, and together they worked out a solution in a few minutes; later in the discussion the same student spoke up and offered her own ideas, and seemed to have been brought back into the fold. This incident strikes me as a fundamentally significant pedagogical event. Such problems, with different theme and variation, are a constant fact of all classroom life, and the hope of every teacher is that they be brought out into the open and resolved. In a conventional class, unfortunately, the student would have grown increasingly diffident and frustrated, and slipped further and further out of reach: I would also guess that a female student might be less likely to ask for the attention she needed. The fact that the student did ask for help speaks well for the ambiance that *Archaeotype* creates; it may further suggest that a small, single-gender group gave her the freedom and the confidence to speak up.

At the very least, it is clear that this project can be used in such a way that it does not exacerbate the familiar problems of gender-bias, and it can even -- as I saw in action -- begin to serve as a remedy.

3) Comparison of *Archaeotype* Projects and Traditional Class Work

Perhaps the most intriguing part of evaluating the *Archaeotype* project has been the opportunity to compare the work produced by *Archaeotype* students and work done by students in conventional courses. I have examined six papers from social studies classes in the Middle School on archaeological and historical subjects; four describe an Assyrian limestone relief from the palace of Assur-nasir-pal (900 BCE); one discusses the transformations involved in the evolution of human societies from hunter-gatherers to sedentary farming communities; the last paper is on the Parthenon in Athens.

These comparative texts demonstrate vividly some of the features of *Archaeotype* discussed in the previous pages. The best papers are well-written and thorough collections of information with appropriate documentation. The description of the Parthenon, the most sophisticated of these efforts, contains a great variety of facts from different sources, and ranges in topic from the mathematical minutiae of the temple columns, to the Athenians' attitude to the late-fifth century building program. The work shows access to and familiarity with some of the basic tools and methods of research, and the student will certainly thrive in university classes writing improved versions of the same.

As much could be said for the students' assessment Or the Assyrian "Birdman" bas-relief. These four papers show less "research" (the assignment was clearly different) and students describe and try to reconstruct the role the sculpture may have played in society and in worship. The best of the papers presents some acute and accurate observations about the details of the sculpture, as well as some interesting speculation.

Each of these very different assignments fulfills an important function. It is hardly controversial that students first need to acquire, and then to learn to process and organize large amounts of information as they advance through their education; and that a creative student will achieve this in more interesting and effective ways. I would like to look closely, however, at a sample of the work I have reviewed, and suggest where it might differ from the work I saw done in the *Archaeotype* project:

> The birdman also has many motifs sculpted on him. A motif is a shape or unit. If a motif is repeated, it becomes a pattern. The motifs on the Birdman are mostly curls. The circles on his bracelet, his tassels, snail curls, and the flowers on his shirt are all motifs. The birdman is very importantly different from ordinary people because of his bird-head. He also has a beak on his head. Most of the other bas-reliefs have human heads. The birdman is in a position that shows you that something is going on right in front of him.

One could analyze this paragraph in a variety of ways, but my interest here is what the student has learned about critical observation. The description is reasonably full: the presence of feathers and wings distinguish the birdman from neighboring sculpted human figures; curls, circles, tassels, and flowers, are identified as motifs which form a sculptural pattern or overall design; a guess is offered as to what is not shown ("something is going on to the right of him"). These are admirable results, the work of a good student confronting an unknown object from a remote place and time: the student has obviously been well-taught and in the best possible traditional setting.

We can proceed next to what the student might have done better, or rather, what we might teach him or her to do better. The student is struggling, first of all, with the dilemma which every critical observer faces: which details are defining and essential, and which are not? The "default mode" in the present case (as it is for most writers) is the kitchen sink. The birdman essay is a rather shapeless collection of facts; the description is static, and details proceed by accident and intuition. I do not mean to be overly critical (I have seen worse paragraphs from a few college students), but we should notice that no amount of coaching on paragraph construction, sentence structure, or the like, will be of the slightest use here. The student has no context by which these data can be given shape, and no argument, despite the fact that the impulse is there: -the birdman has many motifs sculpted on him --"now what?"

we can almost feel the student ask, and then "Oh yea.... 'A motif is a shape or unit'." The student is looking for structure and direction, scanning back through the words and categories he or she has learned, but can discover no logical focus anywhere in sight. There are times when life and scholarship are diffuse and messy and when writing demands we supply order, if not context and argument, but there is nothing more difficult than writing without point.

Archaeotype in many important ways provides the point. Students are obliged to use actively the data they glean from artifacts; accumulation and description are never ends in themselves. As I read these essays I could not help remembering how often I heard *Archaeotype* students say "I've seen that (motif) somewhere before," and then watched them look through their earlier finds or through reference texts. Their vocabulary and body of visual material were clearly evolving and growing, and they knew how to build upon the details they had collected and described. *Archaeotype* students, like any good scholars, have learned that when the data are gathered and the facts assembled, a project is ready to begin, not to end.

These features suggest the more obvious strengths of the program, but I would like to consider some further advantages and benefits inherent in the process of working with *Archaeotype*. The final projects of the classes I observed consisted of presentations of the artifacts found in each quadrant. The presentations are designed by the groups in such a way that they first lead the reader/viewer through the material, and then, by the ordering and description of their assembled evidence, to the group's hypothesis. The viewer is shown an Index and can ask for pictures and information about the artifacts, category by category, and piece by piece: architecture, weapons, coins, statues, etc. Objects (where possible and appropriate) can be viewed from front, back, and side angles, and usually can be seen in close-up. The students provide commentary on each object: some groups decide on a printed text next to the pictures, and other choose an oral presentation, with a recorded voice of students reading the texts they have written.

The myriad choices and possibilities of format require that students make important decisions about the kind of material they have, and the arrangement that will most effectively convey their argument. The burden of mere description is removed, since the object appears on the screen, but there is a further irresistible tendency to include only information which is essential: the torso of a statue was uncovered, for example, which the student had researched and dated to 415 BC; the student then explained the date -- the "wet drapery" style of garment depiction became popular in sculpture about that time -- and further described how the date fit in with her overall analysis of the site. In another part of the same presentation, the students analyzed and described the helmets they had uncovered but also cross-referenced them to other helmets from text-books and from the database in the Perseus program. The viewer could look at a Kegel helmet while reading a description of the helmet's features, and could then call up to the screen three other helmet styles for comparison. The students had investigated these, and included texts which gave the dates of earliest and latest use of the helmets, detailed commentary on their construction, and their relative effectiveness as protection.

We find in these products the ideal features of an educational process. Information-gathering is active, and students are encouraged (where possible) to make their data cohere -- one piece at a time, and then as a whole. The program rewards the creative attempt to make something of motifs and patterns of motifs, to compare them with others, and try to link them to some historical, artistic, or social context. Again, this will not always be possible, but learning the limits of speculation is as least as important as learning to speculate. Developing in students the instinct to look for unities and structures in the data they encounter will benefit them long after the details of the Birdman and the Parthenon have become vague memories. They will be better and more inquiring readers and more circumspect thinkers.

The advantages of this procedure over traditional paper-writing are manifold. *Archaeotype* students have a built-in reason to organize their paragraphs and their ideas: they need to explain their data to an actual audience who needs to be informed and kept interested. They also, whether they choose an oral or text format, are working in a naturally oral mode -- that is, of persuading an actual audience (the viewer) of their opinions. I have taught university writing classes for a number of years and attended conferences and taught workshops on the teaching of writing. The consistent treatment of choice for beginning writers is to urge first of all, that they imagine an audience of their peers, and then that they write as if explaining their material aloud. These exercises are particularly effective in training students to be unaffected, concise, and clear; they also steer students away from the inevitably muddled imitations of "high style" professional prose that can make their writing so disagreeable to read and such anguish to compose. I was immediately struck by the fact that these improving features are built in to the *Archaeotype* format.

It is, furthermore, a dictum of pedagogy that one never really knows a subject until one teaches it. The format of *Archaeotype* demands that students work toward "teaching" their subject; they must know their material well enough to explain it, and their final projects are, in effect, lectures to their peers and teachers.

There is certainly room for and need for the new and old styles of learning. The *Archaeotype* program will not perform miracles, but it will train students to be more aggressive observers and more synthetic thinkers; properly taught, it will enable students to work as creative scholars, rather than as data compilers. They will better understand how the assemblage of facts they confront every day in lectures, published accounts, and, later in life, in the workplace, come into existence, and they will have power and control over these processes.

4) Some Possibilities and Recommendations

A) Expansions

It is clear to me, as it was to some other members of the faculty with whom I spoke, that more efforts should be made to relate the methods and principles of *Archaeotype* with courses and programs in other departments. There seem to have been gestures in this direction by the Mathematics Department, which I think should be encouraged. It will no doubt take time to develop a sense for the most productive directions these interconnections might be made, but I think that they should be encouraged at all costs. The more that this project is integrated into the rest of the curriculum, the more effective it will become.

It is still more important that the Dalton Middle School and High School integrate the synthetic thinking about history and culture students have learned in *Archaeotype* with upper-level courses in history,-language, and literature. This continuity ought not be left to chance: the two models of learning, the active and the passive, should not compete, implicitly in the students' minds; the modes of thinking they practiced in sixth grade cannot be viewed as a gimmick for children, which by high-school they will have outgrown.

I have real doubts that software-generated digs, even in some more sophisticated form, could satisfy high school juniors and seniors for more than a week or two; I am open to persuasion to the contrary, but I suspect that computer simulations of any complexity will lose their effectiveness beyond the Middle School. I am convinced, on the other hand, that the lessons of *Archaeotype* should be incorporated and elaborated as a formal part of advanced courses for upper-level students. The continuity should be explicit: "these are the methods you saw with *Archaeotype*; here's how they look on a larger stage and in real-world scale." Something like a "live" simulated dig at some point during the high-school years, perhaps modeled on the introduction to archaeology taught in Harvard yard every summer, would be a natural project for students with continuing interest. More generally, whole-class projects could be organized which collect every bit of evidence for a single event or character from antiquity; there are dozens of significant characters who could serve this purpose, (Themistocles comes to mind immediately) for whom the entire body of sources could fit into a few dozen pages. Student teams could divide along source-lines (literature, history, visual and plastic art, etc.), and assemble their findings (perhaps in a jointly-owned database program) as they have learned to do with pictures of artifacts; they could work through the semester creating their own narrative of the character or event; These narratives could be compared with the published histories; perhaps (with still more ambition) their conclusions could be considered against a century or two of professional historians' accounts. These are only a few of many possibilities, but I think it is essential that advanced courses confirm in these students their first grasp of the sanctity of evidence, and foster in them the skepticism they will have begun to learn about certainties and facts.

B) Staffing

The faculty who actually work with the students have done exceptional work. Given the interactive nature of the class and the inevitable number and complexity of problems that arise, the ideal number of faculty seems to be two, at least one of whom is thoroughly proficient in computers for quick problem-solving. I also would recommend that (so far as is possible) the core members remain the same for extended periods of time. The same questions and problems will arise over and over, and strategies and ideas for moving through the program will accumulate by experience. Furthermore, the possibilities of *Archaeotype* have only begun to be explored and understood; it is likely that for the next few years the most interesting and useful developments will not come in the form of new technologies, but in the form of new applications for the current technology. Experience and practice will be the best guides.

It would be useful as well to form consulting groups of teachers to share ideas as the *Archaeotype* project grows: these groups exist now, but it is easy to imagine that there will be need for more, and relatively soon. Dalton is no doubt aware that the program will have far-reaching effects, not just on students, but on faculty and faculty roles, and that these changes will occur very quickly. The change from lecturer to "enabler" that takes place with the interactive, collaborative style of teaching will be exciting, and faculty, I suspect, will increasingly ask to be included as they become aware of its results and possibilities. Consulting groups, formal or informal, will help to make the best use of these transitions.

C) The Reference Library

I add this to lend support to the changes which are already taking place in the Dalton Libraries. The Middle School library will need to grow, and will no doubt need to include an expanded and permanent collection of reference books that students will use while working through *Archaeotype* projects. Though the collection of books is very good and is increasing, it is even now being pushed to the limit, and the strains will worsen as the program grows in size and sophistication (no one seems to doubt that it will).

This reorganization should obviously include the librarians, whose pedagogical ideas will be invaluable. Every September at Columbia I teach a seminar in research methods and library use to new graduate students in the Classics department; the basic mechanics of library use seem sadly out of vogue these days, and it would be an added benefit and a great service if students were formally trained (via *Archaeotype*) about working through the basic stages of research, from reference works to more specialized texts. Professional librarians are probably the people best qualified to organize the necessarily scaled-down version of this kind of collection.

D) The Dalton Press?

It occurred to me throughout my review of the library at Dalton as I watched students work through the reference collection that there is no book I could imagine recommending to a junior high student as a introduction to fifth-century Athens or Republican Rome. If you will indulge me in this one last fantasy, I wonder if any of the faculty has considered (either as a solo or a joint effort) writing an introduction to Greek and Roman history and culture? It could perhaps be a conventional book, but I can also envision a text available (at the beginning anyway) on-line, including graphics, maps, study questions, etc. Dalton seems fortunate to have the quality of faculty who could, given the time and resources, produce such a work; they could also tie it in to *Archaeotype* and any of its later incarnations. If I am correct in assuming that few such texts are available, it might have applications beyond Dalton.

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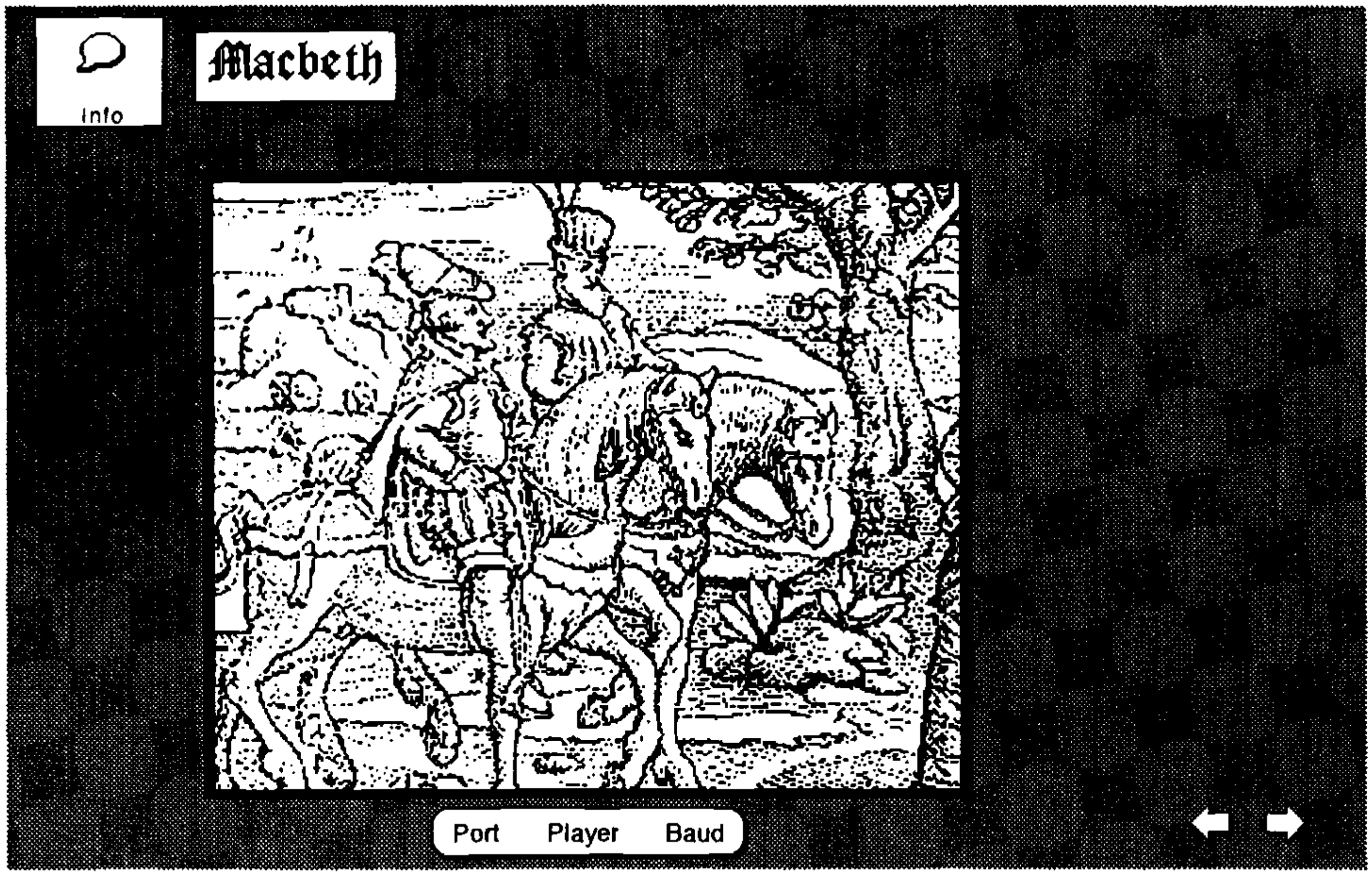
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Evaluation of *Playbill:*
Professor Joseph Voelker

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1) Introduction

Pedagogical experiments in HyperCard technology are very much in keeping with the Dalton School's sense of its mission. The school's "Statement of Philosophy" says, "In addition to the acquisition of the traditional body of knowledge, a high degree of emphasis is placed on inquiry, experimentation, research, and analysis. The latter are the tools, we believe, which will equip our students to engage in the struggle to discover meaning in this highly technological, computerized age."

Likewise, the English department introduces the literature curriculum by saying that "In all four years, students write extensively, respond to assignments in many modes, and, in many cases, have opportunities to devise topics of personal interest."

Hence, the spirit of hands-on experimentation that underlay this first run at a computerized unit on *Macbeth* was quite appropriate for the kind of school Dalton is. Students in groups of three were instructed to devise a thesis, divide the project's labor among themselves, learn the HyperCard techniques, and construct an electronic "essay" that would link to laser-disk storage of versions of the play, a glossary, the text itself of *Macbeth,* an annotated bibliography of secondary sources, and a sizable body of literary criticism. The desired product was a student-produced HyperCard study of *Macbeth* that would possess rich layerings of citation in text and video modes, in support of its contentions.

The Dalton School possesses a happy gathering of circumstances for such an experiment: students already capable of organizing a coherent essay on a work of literature, the necessary technology and support staff, teachers comfortable outside the traditional role of classroom authority, and an institutional commitment to new pedagogies, new technologies. If there is a synthetic discovery to be made that will introduce a powerful new application of computers to literary study at the secondary level, Dalton seems poised to make it.

2) Observations

The school's curriculum book describes the tenth-grade drama course in these terms: "This course seeks to define the special elements of drama and to provide a sense of the history of the genre. Students will be asked to consider how plays might be performed as they learn about the craft which contributes to drama as theater. At the same time, while treating drama as literature, attention will be paid to language and structure. The nature of tragedy and comedy, and what distinguishes the classical from the modern form of each are also discussed." Within that framework, the multimedia unit was supposed to offer a respite and an alternative to the traditional classroom, in which "the teacher interrogates the students about the text," in favor of one in which "the students interrogate the text."

What is an ideal interrogation of the text of *Macbeth* -- what are its components? Whether electronic or handwritten, a student's essay ought to demonstrate an underlying grasp of the sequencing of the drama -- not simply its plot, but its musical sweep, or dynamic -- how we got from A to B, and a sense of the mystery of why. Second, the essay ought to show responsiveness to the poetry: an apron stage and magnificent *words* in an actor's mouth were Shakespeare's only technology, and that reliance on the word is key to understanding the "history of the genre." The essay ought also to be rhetorically capable: it should guide its reader -- even through a HyperCard labyrinth -- gracefully, seeming to know what we are about, and where we are headed. I impose the highest standards in citing the play's dynamic, its poetry, and the essay's coherence: they are the virtues of student work that can be hardest to maintain in going to the atomistic, or at least non-linear, world of HyperCard.

I read several papers from a traditional tenth-grade *Macbeth* unit hoping to see them as a baseline against which I could intuit the gains and losses of a HyperCard study. Of course, human nature what it is, there is inevitably a range of performance in any assignment, traditional or experimental, and I first reflect upon the more successful essays in both genres here, since bad work is usually the consequence of a chaotic set of causes, personal and intellectual. (Nevertheless, there are things to learn from the weaker projects.)

Two very fine "traditional" papers demonstrated a sense of the play as a single construction. One discussed *Macbeth*'s attempt to rid himself of conscience, the other measured the gradual drying up of his soul. The authors seemed to be well-taught, and no doubt they relied -- perhaps heavily -- upon their teacher's presentation of the play over several weeks of class time devoted to close reading. They were also responsive to the poetry, quoting and explicating the richest speeches. And finally, they were rhetorically successful, never seeming to lose their sense of direction, faithful to their argumentative design.

Among the five media projects, one was completely successful in demonstrating a sense of the play's development as an architectural construction. It addressed the exchange of roles between Lady Macbeth and her husband, a topic which necessitates looking at the play as a set of stages. It was responsive to the poetry and cited particularly skillfully the scene in Polanski's *Macbeth* in which the murderous couple washes the blood from their knives. While I think the students are mistaken in seeing the Macbeths as equal and mutual in their influence over one another at this moment, it is clear that the cue for this intriguing thesis is in the actors' interpretation. Also, this presentation was impressive as rhetoric -- in pedestrian terms, its links all functioned. But its prose was consistently graceful and of a piece across the three authors, and it steered the reader in and out of its links without confusion. It is important to mention that the thesis for this essay came from a suggestion of one of the teachers. Subsequently, the students took that suggestion and performed a Boolean search through the criticism, which netted them supporting evidence and refined their idea. But the idea's origin tells us that the teacher's role will likely remain central in subsequent experiments, and that there needs to evolve a conscious sequencing of traditional classroom learning, thesis design, consultation of criticism, division of labor, and laboratory work.

The projects in general revealed a satisfying and even surprising level of familiarity with the play's language. In the classroom, I led a group of students through a brief discussion of the play's "genetic" metaphor. The critic Cleanth Brooks explains the frequency of references to babies, Cesarean birth, generational chains, as a rich metaphor for the sheer persistence of humanity on this planet, and he sees Macbeth's attempt to "scotch" the genealogical lines of his competitors -- to kill all their children -- as lying at the heart of the play's monstrousness and the meaning of the horror of the witches and their cauldron. In that class, the students displayed a facility of reference to the play and a capacity to interpret specific language and to offer other speeches as evidence and counter-evidence. They were able to grasp this complex thesis seemingly without a struggle. Somehow, the students did "interrogate the text" during their weeks spent in the laboratory instead of the classroom. The fact that the projects were not equally graceful and coherent does not indicate that the students failed to learn *Macbeth.*

As with the traditional essays, the weaker performances seemed to be weaker for a wide variety of reasons, some of which are relevant to future planning. It is possible that the way students chose to divide the labor among them hindered their ability to demonstrate a sense of the play as a whole. For instance, the "Women in *Macbeth*" project sent one student off to study the historical issue of the role of women in the Renaissance, and her contribution is rather roughly integrated into the project. Dividing responsibility in terms of portions of the play also leads to a piecemeal sense of its dynamic.

In terms of the poetry, some groups were more adept than others at comprehending their task as one of interpretation. The most pedestrian links were those in which the reader was sent to the laser disk of Orson Welles' production only to verify a fact. For example, we do not need to watch Welles deliver the "tomorrow and tomorrow" speech only to verify that Macbeth is told that his wife is dead.

I want to try to reflect on the quality of personal interaction in the computer lab of the hypertext unit and compare it to the traditional classroom. A full six weeks of the students' time is devoted to the project, and in literary study, the journey is as important as its destination .

For all its stageability, *Macbeth* can be read as closet drama -- a very subjective experience of a solitary reader in a silent room, paying a visit to a surreal interior world. That private, nineteenth-century way of reading Shakespeare does not typify the Dalton experiment. The computer lab is not a large room, but on one of the days of my visit, there were a dozen students finishing up their projects, a cameraman videotaping them, two teachers, a technician, and two other visitors beside myself interested in hypertext education. This is the 1990's version of "closet drama." A noisy reckoning in a little room.

Of course, the lab was typically far less chaotic than on the project's last day, and even then I was able to witness a lively and loud exchange of ideas and points of view on such questions as when the Macbeths begin to exchange gender roles, or how Polanski stages his shots of the witches, or to what extent they were projections of Macbeth's unconscious mind. At this point, students were very aware of their deadline, and some came back for several hours on the final evening. It was clear that they took the project very seriously, and were fully engaged in literary -- as well as technical -- questions. They were also vocally anxious about the way their collaborative efforts would be graded.

A curious consequence of the "experimental" aspect of the unit -- the presence of evaluators -- was that students became self-conscious about the way they were learning. They enjoyed talking pedagogy, playing guinea pig, comparing the *Macbeth* unit to traditional ones, and seemed to pride themselves on their mastery of the play and the computer. As with the finished products, however, the process itself was by no means uniform. Some groups revealed a high level of interactive energy, playing off one another's ideas, struggling to wrest control of the keyboard. In other cases there was resentment within the group that some had shouldered the burden for others, and that the chain was going to be judged by its weakest link.

It is essential to avoid false dichotomies in comparing the lab to the classroom. In the classes I visited at Dalton, students were not passive recipients of teachers' knowledge. Rather, they were verbal and bright and eager to grope toward discoveries through class discussion. What the *Macbeth* HyperCard unit provides, then, is not an escape from an authoritarian classroom. Rather, it offers yet a higher degree of autonomy (the teacher retreating one more step), and the occasion to begin learning to work with others, a skill highly valued in the workplace, and one that traditional education does not teach. (It is no wonder that a group of tenth-graders, many of whom are collaborating for the first time in their lives, should express some anxiety about it.)

3) Recommendations

In its second manifestation, the *Macbeth* unit should first of all narrow its initial focus. I suggest that, instead of "A multimedia project on *Macbeth*," students be assigned problems dealing with "How *Macbeth* is interpreted." The teacher's role should be amplified, especially in the opening weeks, during which the class might read the play and discuss its events and their significance, view in its entirety one video and discuss the choices the director makes, in order to rid the students of the sense of inevitability of any given staging. One might even contrast a given scene as interpreted by Welles and Polanski.

Then the students ought to read a relatively brief single work of literary criticism. In class, the teacher should help them to see its thesis, and should point out the extent to which it, too, like the film versions, is an interpretation, and how we might choose to see a specific scene or speech otherwise, in support of other readings.

In the first-run experiment, students used very little literary criticism, and they expressed a certain aversion to it. When they did resort to it, it was as a bank of inert information, more like the telephone book. As tenth-graders, they are not in a position to see that literary criticism is an interpretive game, an ongoing debate played among skilled readers. The problem is one of authority, and while the teacher in the role of classroom authority undoubtedly holds his or her students hostage to the limits of his or her knowledge of the play, and to his or her privileged readings, at least that authority is a living and guiding presence. Students see the criticism as more authoritative than that of the teacher. After all, it's in print. Thus, if for instance a student clicked "dagger" and was led instantaneously to the sole paragraph he intended to read of a Freudian interpretation of the play, he might well be led to accept in some grotesquely literal way the "information" that "dagger" means "penis."

There are two possible opinions on the proper role of criticism in the project. Doubtless, an immense and uncontrolled collection of criticism provides a rich research base. But to send a tenth-grader into the stacks of Harvard library is not the best use of his time or that facility. It might be better to have a teacher -- perhaps as a summer project -- read and organize ten to twenty of the best and most accessible essays on *Macbeth*, then, using the "delete" key, construct a cut-and paste reduction of the annotated bibliography so that it cites only what the teacher has mastered and made available on the computer, and then be able to send students confidently to a set of known interpretations. (One good essay on Lady Macbeth and gender roles, one on the witches, one on film-adaptation, one on children and the genetic theme, etc. The teacher could rely on the better collections of critical essays -- or casebooks -- for the majority of the essays needed.)

The argument for a closed secondary resource tool -- a homemade "magazine" of *Macbeth* criticism -- rests on certain impressions I have gathered of how the truly successful pedagogical software works. *Archaeotype* seems to possess a dimension of simulation, of game, or pursuit, that computer-based literary study has not yet achieved. If kept in its present direction, the *Macbeth* unit will simply get more films, more criticism, perhaps the O.E.D., but it will still be essentially inert. I suggest letting go of the practice of requiring that students devise a thesis. (It would continue, of course, in the traditional units of the course.) But for the *Macbeth* Unit, in order to foster a spirit of pursuit, each group of students should be handed a written problem, the solution to which is to be found in the closed world of the videos and the criticism. In such a closed world, where the criticism is chosen beforehand, students can fairly be permitted to think of the essays as potential sources of answers *of an interpretive kind.* I suspect that collaboration might work better in the context of pursuing an answer than in pursuing a thesis, since a thesis is typically an individualistic thing, and since many a good thesis is hit upon in the hours just before the paper is due. (The current design, by the way, asks for a thesis too early in the process, before the students have spent weeks rummaging in the text.)

In the first running of the experiment, one group addressed the issue of the extent to which Macbeth is responsible for his actions. They wrote separate opinions on this insoluble topic and then typed them in, with a sincere but weak attempt to synthesize them at the end. But the thesis is much better conceived as an interpretive question, the design of which leads them to a focused interrogation of the text. Suppose a group received a three-by-five card with this problem:

> As we know from our studies in Classical Greek drama, the extent to which a man or woman possesses the capacity to control his or her own destiny remains mysterious at the end of the great tragedies. Nevertheless, directors have considerable leeway in how they choose to interpret a character's free will or lack of it. Among the staged versions available to you, which one most emphatically interprets Macbeth's destiny as being in the control of forces beyond himself? Are there scenes in other versions where the actor gives us a Macbeth more rationally in control? How does this director employ the witches to support his interpretation? What is that the witches are a metaphor for? Clue: the critical essay by Abercrombie Crutwell is useful here.

The teacher might thus direct students through well-framed questions about interpretation to design projects where the narrowness of the question would precipitate more effective collaboration. This example is not great -- but the really inspiring questions would evolve over repeated units, until the best would have the feeling of an intellectual quest.

I would then recommend that students *present* their projects in a six o'clock news format, dividing the spoken lines among them in a dramatically interesting way, and then showing the links on video monitor the way a newscaster shows the film of the fire that gutted a home at 214 E. Spruce St. If they know in advance that their format will be oral, they will possibly collaborate more effectively. I would even suggest that they videotape themselves giving their multimedia report, in a format that goes talking head -- *Macbeth* video clip -- other talking head. Since interpretation cannot end in the joy of the unambiguously "right" answer at the end of the program, perhaps the obligation to give a performance will provide a source of motivation.

Finally, here is a rough lesson plan for a project that attempts in outline form to summarize my impressions of what needs to be done on the next wave, in order to make the best use of the teacher as introducer and counsel, and the technology as playing field for an intellectual game.

Week 1: Class reads *Macbeth* and discusses its plot, the political and psychological sweep of the action. Some close reading in class.

Week 2: Students see a video version in its entirety of *Macbeth* and discuss its interpretive choices.
Students read and discuss one critical essay on *Macbeth.*
Teacher demonstrates its interpretive function.
Formation of Groups.
Distribution of Questions.

Week 3: Students familiarize themselves with HyperCard.
Students submit 1 page description of their collaboration, specifically assigning tasks to members.
Collaboration plans reviewed and returned with suggestions.
Lab work.

Week 4: Lab work.
Submission of written summary of team's answer to teacher's question.

Week 5: Lab Work.

Week 6: Completion and Videotaping of Projects.
Presentation of projects on monitor.

4) Conclusion

A curricular design of a carefully sequenced nature in a closed field of information is probably the next step in the evolution of computer-based literary learning at the high school level. One might feel that such a step constrains students, and limits the field of learning artificially. My best response is to say that many very capable senior English majors at my institution are not capable of making judicious use of an open field of library resources, and require considerable guidance with research. If tenth-graders engage criticism at all, and if they learn to see the act of reading, like the act of stage-production, as a set of interpretive choices (some conscious, some not), then they will have made tremendous progress in their understanding of drama, and they will have taken first steps toward becoming skilled researchers.

* * *

Evaluation of the *Civil War Project*: Professor Steve Golin

Department of History
Bloomfield College

Judged in its own terms, the *Civil War Project* worked. I met for at least an hour with each of the twelve participants (eight students, four staff) and attended a two-hour meeting of all twelve in which the students critiqued the year's experience. All twelve agreed that the Project was a success. During my time with the individual students, they also led me through their projects. Based on everything I heard and saw, I'm at least as enthusiastic about the whole year's experience as were the twelve participants. In this section of my report I want to give specific feedback on the ways in which the *Civil War Project* was successful. In later sections I will evaluate the rhetorical claims made for the Project in the descriptive and promotional literature and make some suggestions.

Most striking to me was the students' involvement in and commitment to the whole year-long course. I wasn't the only one who noticed this commitment of time and energy. Students from the previous year's *Civil War Project* (who took part in the two-hour group meeting) noted that the willingness of this year's students to make "sacrifices" showed that something new and positive had happened. One student from the previous year -- amazed that Dalton students would give up Saturdays, or that second semester seniors would let academics interfere with more traditional activities -- could only hypothesize that this year's group of students were "abnormal." This year's students admitted that they'd been told by dismayed friends and siblings that the course was "a blight, a curse, death," and that they were "dumb" to come in to school or go to research libraries when they didn't have to. But they denied they were abnormal. "I've never been that dedicated to school," said one. Her point was that the *Civil War Project* was involving; even normal types would get caught up in it. "When I think of Civil War," another told me, "I don't think of school, because it's not tedious, except scanning. . . . Anyone would like learning if it wasn't done the way it is in schools."

In describing what had motivated them to get so involved, students most frequently cited the historiography, the Shenton tour, the opportunity to create their own products, and the hope that their work would help others learn. In their minds, all these elements fitted together in an organic whole. The Shenton tour had inspired them. "That manure piled five feet high," said one student, speaking of what he'd learned on the tour about the streets of New York in the 1860's. "I want to bring that smell to you." Drawing on primary sources and a variety of media, students were able to tie together not only what they were learning from teachers and books, but also what they were learning from the walking tour, from each other, and even from other courses. One student, whose multimedia project focused on the Astor Place riots of 1849 (concerning rival actors) and took the appropriate form of a play, was able to draw on his A.P. history course, his film course, and his work in playwriting. As he put it, "I saw I could play with everything else I was learning." In addition, the data-gathering and the multimedia projects offered students the chance to do something meaningful for future students. "We mainly take courses for ourselves," said another student. "It's exciting to be part of something bigger."

But probably the biggest surprise for me was to see how powerfully the students had been affected by the experience of historiography. Through close examination of the values and bias of a renowned television documentary on the Civil War and of written history, they acquired the habit of seeing the historian behind the history. Five separate students brought up the historiography as a personal turning point. "I was never that interested in history," said one. "But this year we saw the real problems historians face with bias, with what is a fact." What was the turning point for you, I asked a second student? "Deconstructing Ken Burns. Watching someone critically examining something I might have taken for granted." A third student, whose project consisted of deconstructing images, explained that "Mr. Napoli got me started on this. At first I was all caught up in Burns. But he showed me how manipulative he was." To a fourth student, the historiography and her own multimedia project were the high points, and in her mind they went together: the historiography showed her that much of what is taught in school "is really society talking," and the project gave her a chance to talk for herself, without either a teacher or the requirements of a linear paper imposing artificial limits on her work. All these students felt the power of the historiography and the connection between it and the multimedia project. The decisions which the project forced them to make -- which links, which documents, what commentary to include -- brought home to them the complex historiographical issues of bias. As a fifth student said, "The first revelation was in class, [which was] then supported by the Project."

In the minds of the students, there were two revelations: history is produced by people, and I can produce my own. Instead of just taking one more course that gave them still more information, students were invited to critique what they'd already been taught and to discover their power to teach themselves. They responded to this double invitation with enthusiasm, intelligence, and sustained commitment. In an appropriately challenging sequence, they moved from critiquing history to authoring it. What they responded to most immediately, I think, was being treated with respect. For once, their full intelligences -- visual as well as verbal, creative as well as critical -- were engaged. Challenged and supported by the staff, borrowing ideas and approaches from each other, they rose to meet the high expectations of the Project.

So I'm not very concerned about some of the complaints or criticisms I heard. From students: there was a lot of stress; the staff used guilt to make us work harder. From faculty: they didn't learn enough about the Civil War; or they didn't learn enough about the technology. All these things are true. But they come with the territory. Given the complex demands made on the students, I'd be amazed (and a little worried) if they learned enough history to satisfy the historian on the staff, or enough about the technological tools to satisfy the programmer. The staff became deeply involved in the Project. Like the students' complaints about stress and guilt, the territorial claims and frustrations of individual staff members are a sign of the over-all health of the Project. Attempts to fix these problems might well be counter-productive.

For instance, one staff member suggested to me that the students in the future might be guided to select particular projects. At my next interview, I tried this suggestion out on two students who had done a project on women. "I wouldn't have spent as much time on, say, a white male Irish laborer," said one. Said the other: "It becomes your life. No one should be assigning projects." Again the students, in their wisdom, went to the heart of the matter. The messy balance between freedom and structure -- like the messy balance between history and technology -- was what they loved about the course. More than the staff, the students believed that the experience of the course had been a coherent one. Unburdened by the ambitious program goals that gave rise to occasional doubts in the staff, the students saw that they had learned a tremendous amount. Of course, the Project can be improved; I heard some good ideas during my two days at Dalton, and I will try to offer a few of my own. My point is that students, who experienced the course as an organic whole, with the historiography and the multimedia projects reinforcing each other, have something to teach all of us about respecting the fragile ecology of the Project.

The freedom that students had to choose their own directions turned out to be a cornerstone of the course. To me, the single most impressive feature of the multimedia projects they developed was their variety. Students borrowed documents, pictures, and devices from each other, as they were meant to do. Yet the projects are strikingly different, in content and in form. In addition to the projects on women (in New York City circa 1863), on the Astor Place riots, and on deconstructed Civil War images, multimedia projects focused on the free black community in New York, on the look and feel of key locations in the city during the Draft Riots, and on newspapers in New York at the time. And the strategies and styles of the six projects are almost as diverse as their subjects. One is conceived as a magic bus tour, another as a play; one offers running commentary, leaving space for users to add their own, while another refuses all commentary except for the users'; some include HyperCard movies, others do not, and one includes the sound but not the pictures. All make a number of fascinating links -- from document to document to picture to close-up of picture to historical background to commentary to statistics to stories to sources to movie. The variety of links and of projects adds richness to the texture of the *Civil War Project*, and confirms the importance of letting students determine their own directions.

For purposes of comparison with the projects, I was given three Dalton and four Trinity papers written for Civil War sections of traditional American history courses. The multimedia projects focus on local, New York history, whereas the Dalton and Trinity papers are national in orientation. Compared with the more traditional papers from Dalton and Trinity, the multimedia projects are livelier, more personal and more original. They take more joy in primary materials than do the papers, and when they do cite secondary works they tend to use more recent ones. They are more open to experience -- one project skillfully links the beating of Rodney King, in a HyperCard movie, to the draft riots -- and more independent in spirit. One student in the *Civil War Project* ended up criticizing two of the major historical studies of northern blacks for "their virtual exclusion of women and children, making a description of daily life impossible." For her, the way to daily life was through primary sources. "It is one thing to state, in a secondary source, that religion played a very important role in the lives of African Americans. . . . However, when one sees this actually manifested in primary documents, what seems merely a statement in a secondary source is conveyed with much more power and reality." Another student, asked at the end of the year to summarize what she had learned about the draft riots, responded by describing the religious, ethnic political, and class conflicts in New York, and concluded that "What I have described are tensions which existed in the city every day. You can't ignore these tensions when considering the causes of the Draft Riots. To isolate the Draft Riots from them would be to ignore the lives of those involved." The students' excitement about getting below the generalizations of secondary works to the raw materials of history is visible in their multimedia projects. But the projects are also less professional, less academic, less polished than the papers written for the conventional courses at Dalton and Trinity. Those papers (six of the seven were A's, including two A+'s) are good imitations of what historians do, whereas the projects convey why anyone becomes an historian in the first place.

Evaluation of claims made for the *Civil War Project*

Judged in their own terms, or compared with more conventional high school history products, the multimedia projects are impressive culminations of a powerful year-long learning experience. But judged in terms of the rhetoric surrounding the Project, the projects fall short. Most of them are not finished; some will never be. More important, only half of the projects really deal with the Draft Riots. In form, too, half the projects do not meet stated goals, in so far as only three of the six effectively use the visual dimension opened up by the new technology. In terms of the emphasis on collaborative learning in the rhetoric, I found only two student "teams," with four of the students working individually on projects, although it is true that even they engaged in a great deal of borrowing and sharing. However, my impression is that the collaborative dimension of the learning in the course mattered more to faculty than to students.

The most important claim made for the projects -- that next year's students will use them and build on them -- is problematic. We won't know for sure until next year. But I find it hard to imagine that next year's students will want to use most of this year's projects. Certainly they will use the programs developed for this year's students, and they may well use some of the documents and pictures that this year's students scanned into the data base -- which would be wonderful. But most of the multimedia projects themselves, with the exception of the projects on women and on free blacks, do not seem focused or substantive enough to be useful to future students and thereby contribute to building a cumulative history curriculum. Impressive in themselves and as part of the course, the multimedia projects do not live up to rhetorical claims of a paradigm shift in education.

Nor does student achievement in the course as a whole. One document, dated 11/14/91, proposes six goals for student achievement.

1. Students should gain an in-depth understanding of the Draft Riots. . . .
2. Students should gain a real understanding of the political,

social, cultural, and economic issues raised by the Civil War in New York City.

3. Students should gain a creditable introduction to the issues raised by the Civil War in a national context.
4. Students should be able to do historical research with primary and secondary sources at something approaching a graduate level.
5. Students should gain enough control over computer resources to design and navigate a sophisticated multimedia environment.
6. Students should understand classic historiographical issues of bias, framing, data selection and thematic emphasis. . . .

My sense is that most students clearly achieved goal #6. They did show some historiographical sophistication, in conversation and in their projects. By contrast, I didn't see evidence of graduate-level research skills (#4) -- undergraduate yes, but graduate no. Concerning historical understanding of local and national events (#1,2,3), the evidence was mixed; most students learned a lot about New York during the Civil War, but only a few seemed to have a strong grasp on the national context. And while students did learn how to navigate a sophisticated multimedia environment, they did not learn how to design one (#5); the programmer and the students agree that in practice he did the designing.

The usual approach in evaluations, when a discrepancy is discovered between goals and achievements, is to fault the achievements. But I'm so impressed with the achievements -- with what the students learned and produced, and with what they and the staff together created -- that I'm not inclined to take the traditional route. Rather, I would suggest that in this experimental course, goals be considered experimental too. As the course evolves, the goals will need to evolve. We might trust the wonderful experience of the students and staff, and modify the theory to fit the experience.

For example, the theory privileges the revolutionary role of multimedia technology. And in actuality the technology proved transforming. But it was only one of three transforming elements in the course. Equally vital were the style of pedagogy and the kind of history. Students responded as much to the small group atmosphere and individual freedom, and to the exposure to historiography and social history, as to the chance to create their own multimedia projects.

In keeping with the theory, one staff member expected that the pair of students who were quickest to grasp the technical possibilities of multimedia would do the best project. What he found instead was that the most exciting and useful project was done by another pair, "who seemed technologically adrift, [but] had a strong conceptual idea, and that got them through." Driven by their mission to bring women into the Dalton curriculum, this pair picked up the technical help as they needed it. In my opinion, the most brilliant use of multimedia was made by precisely this pair, when they turned the camera on Dalton faculty and students; the resulting little HyperCard movie, embedded in their project, makes their point about the place of women in the Dalton curriculum more eloquently than print media could. Experience suggests that the possibilities of multimedia can inspire a few (male?) students to play with the technology, but that only strong commitments and a strong point of view can drive students to discover what they want to say and how they want to say it.

In another sense, New Lab experience is already modifying theory. According to a popular version of the theory of the computer revolution, the more effectively computerized or networked a school becomes, the less teachers will have to do and the fewer teachers it will need. In fact, experiments like the *Civil War Project* indicate that computerized schools will need more teachers, and New Lab staff emphasize that computers, far from simplifying the role of teachers, actually makes that role more complex. In the *Civil War Project*, students needed people not only to help them with the technology but also to help them connect the technology with the history. (Sometimes faculty needed this help too.) The student to faculty ratio was in fact two to one. This ratio raises disturbing questions, which can't be answered here. Part of the New Lab vision of *New Wine In New Bottles* is of a democratization of knowledge. Its authors point to the decreasing cost of the new technology. But in addition to the cost of the technology there is the increased cost of instruction, and of faculty development. If there is a way for schools to employ the new technology in a democratic way, educational theorists will have to come to grips with the actual costs.

Suggestions and Implications

I've criticized some of the rhetoric surrounding the *Civil War Project* because the experience of students and staff in the course deserves to be taken seriously, and the rhetoric sometimes gets in the way. Now I'd like to examine implications of that experience, and make some suggestions.

Some limitations of the *Civil War Project* can be overcome in the future. For example, as children born in the 1980's move into high school, bringing with them their great ease and skill with computers, it will be possible for the programmer to do more real teaching, and for the students to do more programming. A more basic limitation is that students in the course do so many things -- historiography, Civil War history, local history, walking tour, visits to real libraries, original research, HyperCard, multimedia program design -- that they cannot do any thoroughly. The strength of the *Civil War Project* is also its limit: the rich mix of learning history and HyperCard, of doing papers and multimedia projects, of critiquing and creating, stretches the students as far as they can go. To get more from the students , Dalton would have to give them more time. Here the best suggestion I heard came, not surprisingly, from a student: make the multimedia project into the senior project, so that students will get credit for two course units. But no miracles should be expected. In the future, the *Civil War Project*, like most great learning experiences, will remain a rich, messy business. Students will continue wonderful things, and to fall short of the expectations contained in the descriptive and promotional literature.

Some of the limitations of the *Civil War Project* came from it being an experiment conducted at the fringe of Dalton education. What if, from the beginning, Dalton students were invited to play with primary sources in history and to imagine what most people's lives were like? What if, from say Middle School on, they were introduced to the idea that all historical interpretation is necessarily shaped by the values of the interpreter, and encouraged to find the bias in some famous texts or films? And what if Dalton firmly re-embraced the progressive pedagogy of its youth, making the student's experience into the touchstone of the curriculum? Combined with the growing ability of future students to use computers to express the complexity of what they are learning, changes such as these have the potential for making social studies at Dalton more exciting, more real, more involving, and more central to the curriculum than they currently are.

The response of the eight students to the historiography and to the history of everyday life in the *Civil War Project* suggests that there is something missing from the history they had previously taken. The students themselves raised this point. "Now I think history as taught here is a disgrace," said one. As I already described, the historiography raised issues about objectivity that appealed to students who had not previously been excited by the traditional political narrative. They began to see historians as real people dealing with real issues. The social history (the history of ordinary people and of daily life) had a similar effect on most students. The student who did her project on blacks believed that Dalton's history department was "not very interested in history itself." One of the students who did the project on women complained that "after a Dalton education, I thought that behind every great man there's a great woman -- until I read Gerda Lerner, suggested by Mr. Napoli."

According to the students, it is precisely great men who form the heart of Dalton's American history curriculum. Not coincidentally, of the seven traditional Dalton and Trinity papers I was given, six dealt with great men (Lincoln, Fitzhugh, Garrison, Clay, Douglass, Carnegie, Gompers); the only exception, a lively but awkward study of the rise of the KKK which did not receive an A, was criticized for not dealing enough with leadership. The enthusiastic response to the historiography and the social history in the *Civil War Project* suggests that Dalton students are being short-changed. I think that many don't even know what they're missing. Wealthy or otherwise privileged students are very susceptible to the implicit flattery of being asked to put themselves in the place of decision makers like Lincoln. By exposing students to non-traditional forms of history -- non-traditional at Dalton, but dominant at the universities -- the *Civil War Project* offered eight students an alternative view of history, and began a process of change at Dalton. But for the process of change to go forward, New Lab activists will enter into a real dialogue with the history department. Such a dialogue will require, on both sides, a modicum of trust, and more than a modicum of respect.

The absence of dialogue would be increasingly damaging to students, who sense the conflict and -- in the absence of open discussion -- come up with their own theories. One student gave me the following cynical explanation for the emphasis on technology in the rhetoric surrounding the *Civil War Project*. "It's essential for Dalton allowing a course like this. The technology provides justification. If Mr. Napoli just wanted to teach a course in historiography, I don't think the history department would be receptive to that. But if we can say we're on the cutting edge. . . ." The alternative to growing cynicism -- among faculty as well as students -- is open dialogue. For such a dialogue to have a chance to succeed, the higher administration will need to stay out of it, allowing faculty and students to talk with each other.

In addition to its non-traditional approach to history, the *Civil War Project* took a non-traditional approach to teaching and learning. I've already described how the emphasis on student involvement and initiative seemed to compliment the emphasis on historiography and on multimedia project design. Are issues of teaching and learning openly discussed at Dalton as a whole? I ask because I couldn't tell from my brief visit. Will the results of experiments like the *Civil War Project* become known to the faculty in general? Do teachers feel safe enough to articulate their different strategies and to listen to each other -- and if not, is there some way teachers could be helped to feel safe? My concern here too is that the success of the *Civil War Project* not become the secret of a small group of innovators, but rather that the implications of its success enter into the life of the school. In part, I'm raising the question of audience. Is the primary audience for the Project, and for this evaluation, the school itself, or is the primary audience potential funding agencies? At what point do the results of experiments need to become the property of the whole school? Can change be brought about solely by end runs, or do the advocates of change need to also risk some plunges up the middle?

* * *

3) Proposals, Reports, and Initiatives

Education should not be a dumb matter of trial and error. It moves instead through cycles of trial and reflection. Both teachers and students flourish when they become reflective practitioners, people caught up in practical actions yet moved continuously to reflect about the what and the why of those efforts.

Reflectivity should continuously inform work supported through the Tishman Project. Too often technology gets put into classrooms, unreflectively, without thought about its purpose or about the processes for using it well.

In managing the Tishman Project, we are trying to engender reflection among its participants. We want specific projects to be rooted in the goals and concerns of specific teachers and groups of students. But teachers and students must possess those projects, not as entitlements, but as reflective achievements. For that reason, we expect participants to keep developing proposals, plans, and reports, and we will not support proposals that seem perfunctory and thoughtless.

Dalton is uniquely positioned as an innovator in technology and education. It is a resourceful, kindergarten through twelfth-grade school, with strong ties to important cultural and academic institutions. Almost all public schools, and many private schools, serve only one or another age segment in the school population. Yet the benefits of technology in education will not neatly unfold according to those established divisions. At Dalton we can work in a coordinated way with students from the beginning of schooling through entrance to college. Apart from anything else, this imparts a great strategic importance to the Tishman Project.

We present a variety of working documents in the pages that follow, starting with our internal call for proposals. The purpose of the Tishman Project is not simply to install as much technology in Dalton as we can. It is to use technology in the systematic improvement of educational work at Dalton. Our request for proposals, circulated in the Fall of 1991, invites the Dalton community to think through what they might do with new information management tools. We then offer a sample of internal proposals, plans, and reports in a way that accentuates our commitment and ability to work across the age spectrum. Some of our developments are school-wide in conception. We present documents relating to these first. Then we work up the age ladder -- First Program, Middle School, and High School.

Another key advantage to our project, in addition to our working across the whole chronology of a child's development, is our ability to work across the whole range of technical opportunity. We define this by the short-hand terms "Builds," "Buys," and "Infrastructure."

"Builds" are programs that we design and create, using the active classroom as the development site. *Archaeotype*, the *Civil War Project*, *Playbill*, and *Dinosaur Canyon* are examples of "builds" taking place through the Tishman Project. It is difficult to use the classroom as a development site, but very fruitful. Developers who look at educational settings and then retire to distant development labs lose a major creative opportunity. In their labs, what they saw in the classroom tyrannizes their creative imagination -- they basically design for a static image of classroom practice. By working in the classroom, they can design much more freely, working iteratively with teachers and students to discover new ways to use school space and time. Rapid prototyping resources and techniques make such on site design and development possible.

"Buys" are another way to make software development responsive to the realities of education. Many software vendors and publishers try to develop turnkey systems for schools -- "integrated learning systems" in their jargon. These are not at all what we mean by "buys," and they have no place in the Tishman Project. The opportunity for "buys" in our sense arises because the marketplace is generating an incredible diversity of software that educators can select and deploy to facilitate the work of teachers and students. *Project Galileo* in astronomy is our pre-eminent example. Both professional and amateur astronomers are developing all sorts of digital resources to serve their purposes. We are acquiring these and combining them with programs designed for the general marketplace -- spreadsheets and the like -- to make a novel environment for the study of astronomy.

"Infrastructure" is in part the sum of our "builds" and "buys," but it is also a distinct effort in itself. We think that information technology will deeply transform the intellectual experience of education. For centuries the curriculum has been stepped, with specific treatments of specific subjects allocated to specific grades. This is the "graded curriculum," in which particular materials are available only to particular children at particular times and places. We think the "graded curriculum" is giving way to the "cumulative curriculum," in which all materials will be available to all students at any time and place. Our effort with "infrastructure" -- the Dalton Network and Multimedia Library -- aims to make the cumulative curriculum possible.

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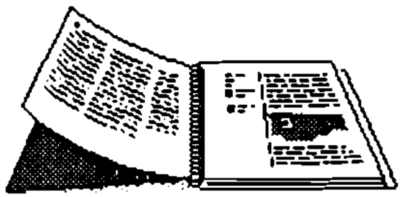
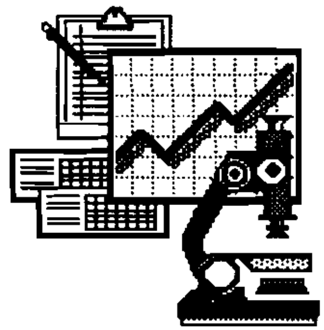


What is Women's History?

1



The A.A.U.W. Report

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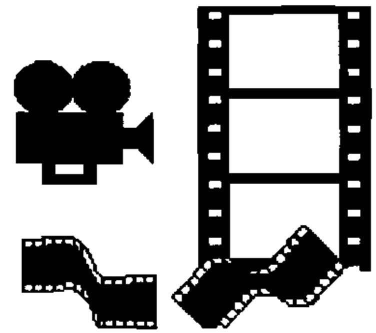
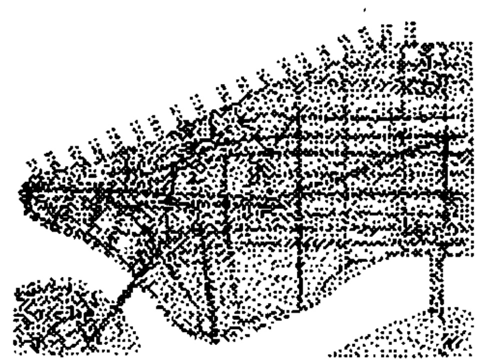


Interviews with students & teachers

3

Summary of the Civil War N.Y.C. Draft Riots

4



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A Request for Proposals

The New Laboratory for Teaching and Learning

Mission and Goals

The New Laboratory for Teaching and Learning is an integral but distinct part of the Dalton School. The philosophy of the School provides a context for the mission of the NLTL. Specifically:

1) Dalton is a learning community committed to the growth and development of all the members of the School including the children, faculty, administration and staff;
2) Dalton is committed to an informed process of change in which innovation is balanced by careful evaluation;
3) Dalton is committed to a constructivist pedagogy which focuses on the individual student as a maker of meaning and intellectual empowerment manifest in the Dalton Plan, whose pedigree is the humanist progressive tradition of Plato, Rousseau and Dewey;
4) Dalton views its classrooms as large as the City itself and sees collaboration with a full range of institutions as part of its life blood;
5) Dalton sees itself as having a responsibility to provide leadership in a world of education;
6) Dalton seeks to serve the larger community through projects it shares and support it offers.

The NLTL defines its mission within these broad parameters. It seeks to initiate and manage projects which are experimental but not removed from the practice of education. Specifically, the NLTL seeks to:

1) pursue the question of how to make science education effective both in the context of curriculum development and professional development;
2) explore the ways in which interdisciplinary studies, bridging the humanities and the sciences, can enhance the creation of constructivist educational environments;
3) anticipate the ways in which the new technology may be used to

implement a philosophy which views education as learning how to learn as well as mastering the tools associated with the disciplines;

4) provide the focus for the collaboration with other cultural and educational institutions in order to properly enhance projects as well as implement the City as a Classroom program;
5) establish an environment in which faculty can pursue experimental projects with the support of the NLTL staff and receive *ad hoc* training when needed;
6) demonstrate by outreach efforts the benefits of institutional community services.

Phyllis and Robert Tishman Family Project in Technology and Education

Mission and Goals

The Tishman Project, as the flagship project of the New Laboratory for Teaching and Learning, seeks to mobilize the transformative power of the new technology as it develops, to the end of defining and implementing the Dalton Plan for the twenty-first century. This will be best accomplished by using the Cumulative Curriculum concept as the philosophical armature of the specific programmatic efforts. Concisely stated, there are three operative concepts involved in the Cumulative Curriculum.

> First, all information should be available to everyone throughout the school at all times;
>
> Second, the scope of available materials will be increased significantly;
>
> Third, the pedagogical devices used to activate the educational environment, the applications, should focus student attention on a specific field of information and inquiry but have built-in centrifugal accelerators which inspire/require students to reach beyond the immediate field of information into the larger multimedia library and to human and research resources beyond the local environment.

The specific goals of the project are:

1) to lay the groundwork, by the creation of local networks within the school, for the eventual development of a single multimedia library from which all information will be accessible to all members of the school;
2) to develop Dalton's capacity for collaborative learning and writing through the establish-ment of local networks, the identification and deployment of selected soft-ware, and the appropriate pro-fessional devel-opment support;

> These guidelines set proposal-writing standards as high as those of major funding organizations. We do that most fundamentally because we believe that hierarchical (and invidious) academic distinctions between universities and research organizations on the one hand and schools on the other should be broken down. Schools such as Dalton can and should compete with the best for research and development funds.
>
> In reality, however, the constraints under which teachers work, including those at Dalton, make it more difficult to meet such standards comfortably. In practice, we have accepted proposals in a more rough and ready state than our guidelines require. In practice, the guidelines serve more as a goal than as a precondition. But they are an important goal -- the Tishman Project initiatives need to compete for funds from the NSF, OERI, and major foundations, if we are to bring them to full fruition over the coming years.

3) to revitalize and redefine (return to its original roots) the vehicle of the Laboratory by reestablishing the Laboratory as the more common environment for study and the site in which the execution of Assignments takes place in both individual and group context;
4) to develop a functional design and a prototype for the multimedia library;
5) to work towards the creation of a set of generic tools deployable within a multiple applica-tion environment;
6) to develop specific applications broad-ly related to the traditional disciplines with the potential of each to serve as the focus for the mastery of skills, the introduction of questions from the range of disciplines, and as a launch pad for the

definition and development of individual interests.

Proposal Guidelines

I. PROJECT NARRATIVE: The narrative of your proposal should include the following, not necessarily in the order presented here.

1) Search: All projects should have contained within the narrative what is traditionally called a literature search, that is, an indication of any related research, existing software or related pedagogy you feel is the pedigree of your specific project. This is particularly important so that we don't undertake building new tools that may already exist.

2) Project Origin: You should address the question of the etiology of the project: the origin of the project in your own experience as well as how you see the project in the larger context of educational development in the professional arena.

3) Project Purpose: There should be a clear statement of general purpose which includes both content and skills questions on the one hand and pedagogical and philosophical concerns on the other.

4) Technology Focus: The narrative should address the question of how your project shows the power of the new technology.

5) Student Assessment Models/Issues: You should indicate what means you will use for the assessment of student performance and the diagnosis of student difficulty in the context of a functioning prototype. This is particularly important since many of the Tishman Projects will make greater use of student collaboration and peer teams and, therefore, it will be more difficult to use traditional methods of assessment and diagnosis.

6) Unique Problem Areas: Each proposal should indicate the problems that are specific to itself.

7) Relationship to Whole: Every project proposal should indicate how it is linked to the stated goals of the Tishman Project (see Tishman Project Mission and Goals) and, in

that context, address whatever issues pertain to networking, particularly in light of the Multimedia Library Project.

> Technology-based innovations may provoke the fundamental reconfiguration of student assessment practices. During 1992-93 and beyond, we intend to devote careful attention these possibilities.
>
> The question of student assessment presents both a threat and an opportunity. If we cannot develop new means of assessment, we risk gravitating back to the normal of common practice under the pressure of current assessment practices. To sustain innovation, we need to enhance through information technologies our abilities to give classroom-based feedbacks and school-wide assessments in ways consistent with student-centered education.

8) Professional Network: Each proposal should give a clear indication of the professional affiliations outside of the Dalton School and Teachers College that will be used in the process of development.

9) Evaluation: You should express your philosophy of and concerns about the evaluation of the project. This should include problems which arise from breaking out of the traditional more measurable environment.

10) Dissemination: Each project ought to have in its narration a description of its means of disseminating itself both internally within Dalton and externally within the larger educational world.

11) Funding: Each project should indicate where it intends to go for additional support within the larger funding arena outside of the Tishman Project.

12) Documentation and Publication of Findings: Each project should indicate where it intends to publish its findings both in popular media and scholarly media.

II) PROJECT GOALS: The project goals should flow from the narrative and should represent the primary development components of the proposed project. It is important to make certain that everything you intend to do in your project can be subsumed under one or another stated goal.

III) PROGRAM IMPLEMENTATION: Program implementation involves the operationalizing of the project goals and has two parts. The first part is the breaking down of each goal into the appropriate number of objectives. Each objective should describe a task to be done or, in the words of social scientists, behaviors to be performed. The second part of program implementation involves taking each objective and deciding how the successful accomplishment of that objective is to be measured. The description of those measures are called Performance Evaluation Measures. There are some examples on the sample forms which follow.

IV) MILESTONES: Milestones are merely a calendar to trace the development and completion of objectives. The program tasks which constitute the X axis of the milestone chart should be pulled from the Program Implementation Outline (III). The Y axis of the chart represents the days of each month. A small triangle should be used to indicate a milestone which can then be colored in when that milestone is accomplished.

V) BUDGET NARRATIVE AND SUMMARY: You should provide a detailed budget and narrative. Be certain that in your budget narrative you are as explicit as possible in describing the reasons for the various items you have included. Please also include in your budget and budget narrative any monies which have already been spent on your project in anticipation of your proposal. The grant period is essentially from whenever your grant is approved to August 31, 1993. Do understand, however, that each project will be reviewed before September 1, 1992 to determine whether significant enough progress has been made to warrant 1992-93 funding.

> As our experience has developed, we have learned that budgeting cannot be done precisely on a project by project basis, particularly with respect to dollar amounts. Many resources -- equipment, software, and staff -- serve many projects. Consequently, we now ask that project leaders give a careful description of the functional needs for technical resources that they will generate through their project.

* * *

School-Wide Initiatives

Through the Tishman Project, we have the opportunity to work in a coordinated way across the whole school curriculum, from Kindergarten through entrance to college. This is an extraordinary advantage of the Project. We seek to grasp it in two ways -- to design curricula and to develop systems with it in mind.

Our school-wide systems development effort involves the creation of networked, multimedia resources that should become ubiquitous through the school. We will discuss these efforts shortly in describing the Dalton Network and Multimedia Library.

Our main school-wide curriculum effort has so far centered on re-examining the place of computer science in the education of the child, from the start to the finish of schooling. The basic concern here is to see computer competency -- neither computer literacy nor computer science -- as a pervasive educational opportunity. We aim to recast programs and requirements to engender high levels of computer competency in each Dalton student. This is an important initiative to which the academic leadership of the school has devoted much energy.

* * *

Toward a Computer Competency Curriculum

Notes for an Implementation Strategy for a Computer Competency Curriculum:
Peter Sommer
Middle School Director

Patterns of Computer Use in Schools

Schools go through a common series of developmental stages in their use of technology:

The P stage: Schools teach Programming and treat the computer as an object of instruction. At this stage, the computer is a Peculiar item in the school, usually a Personal item perceived of as "belonging" to one or two teachers or rooms in the school.

The D stage: Schools use computers for Drill and practice in the regular curricular Disciplines, especially in math and reading.

The T stage: Schools use computers as productivity Tools, Tailored to the needs of students, Teachers and the curriculum. Schools move away from direct instruction with computers and toward the use of general tools such as word processing, databases, spreadsheets, and telecommunications.

We are entering the T stage. We wish to design a strategy by which to reach the next two stages:

> As we integrate technology throughout the school, computer skills will become far more pervasive. In anticipation, the school is redefining computer science requirements, integrating them in turn throughout the curriculum. This is one of the key documents reflecting the discussions of a broad-based committee charged with examining the issue.

The T^2 Stage: Schools use the "new class of tools" (such as multimedia), large on-line CD-ROM databases, laptop word processors, and so forth, throughout their curriculum and operations.

The U stage: Computers are Ubiquitous in the school. Used for everything. They are as commonplace as a pencil or a book. Computing is Unobtrusive and Uneventful, part of the Usual and customary school day.

As we bring computers to education and enter these last two stages we should therefore focus on familiar, traditional subjects first -- on topics that are related not to the computer but to the curriculum. Students need take no computer classes or programming classes. We wish to find out an answer to a very simple question: What would happen if students had access to computers all the time?

Within three years, the use of computers in every classroom at Dalton will be feasible on a daily basis. This prospect presents a variety of opportunities and entailments. We wish to provide time for each faculty member to make use of these resources in her classroom. This may require a reconfigured student schedule.

Socrates could not have educated Plato as he did if he had 59 other students, four 40 minute periods a day. We discovered many years ago that under these conditions it is virtually impossible to make "wrestling with ideas" and "aiming for wisdom" educational goals for all students. Now come computer tools which can help us scale the pyramid of wisdom. Before we can expect these powerful technologies to take hold, we need to raise our expectations. How do we raise educational expectations? We must demonstrate how technology can help change our school and how technology empowers learners and teachers. Technology can be the spark that lights some new fires and restores loftier educational goals to our school.

Implementation Summary

Grade Level.	Program.	Hardware Configuration.
K-1	Computer as warm fuzzy.	2-3 computers per room.
1-3	Logo, beginning keyboarding, mousing. Turn computer on, shut it down, handle disks, open, save, and close files.	2-3 computers per room. Computer Lab w/10
4-5	Keyboarding, word processing linked with writing process, computers in mathematics -- drill, problem solving software -- commercial and teacher scripted.	4 Mac's per classroom.
Focus now Shifts to Core Academic Integration		
6-8.	Core academic integration. Computer in SS, Eng., Math. Developed as PE, Art, Sci, Music tool.	8 Macs per team. (3 teachers -- SS, math, Eng, 45 students). Computers on the network.
6.	English, *Archaeotype*. Math integration; Network.	
7.	New Math Program (Geometer's Toolbox). New *Archaeotype* and/or US History software.	

8	Pollak English; Electronic Research - - SS; (Remember English can now assume WP skills); Computer based art elective; Computer based music elective.	
HS	Computers are not computer science. New computer competency requirement. Computer competency course(s). Computer science course(s). Departments develop courses in which the major acquisition and exhibition of command of subject matter is through the computer.	5th and 10th floor microlabs. 4 computers in each department's lab. Move towards CPS.

HS Computer Competency Requirement

To incorporate following skills:

1) Fluency in an operating system.
2) Fluency in one complex program.

   Examples: spreadsheet, *Galileo*, Mathematica, an authoring language, computer language, desktop publishing, CAD.
3) Ability to run an interface with another subject area.

   Examples: statistics program for physical education; simulate or control theater lighting, historiography, music synthesis.
4) Facility with a remote communications system (via network or modem).

One may meet the above listed goals by successfully completing any one of the following:

1) Computer competency course.
2) Computer science course.
3) A junior or senior project approved by the HS Director.
4) Selected HS courses, approved by the HS Director, in which major acquisition and exhibition of command of subject matter is through the computer. Examples: Civil War CD-ROM,

linguistics, astronomy.

Software Implementation

Identify targets of opportunity by teacher, grade level, and department for

1) Software:

K-1) *EZ Logo* (MECC)
Gertrude's Secrets (Learning Co.)
Mix and Match (Apple)
Mop Town Parade (Learning Company)
Sticky Bears (Weekly Reader Family)
Talking Textwriter (Scholastic)
Dinosaurs (Advanced Ideas)

2-3) *The Puzzler* (Sunburst)
PAWS
Logo/Lego
Primary Editor Plus
Children's Writing and Publishing Center
Mammals: A Multimedia Encyclopedia (NGS and IBM)

4-5) **Palenque*
The Voyage of the Mimi
Gulliver's Travels
The Weather Machine (National Geographic Society)
National Geographic Kids Network (TERC)

6-8) **Point of View* (Learningways of Cambridge, MA)
World GeoGraph
GTV (National Geographic Society and Lucasfilm)
**Columbus* (Synapse/IBM)
Apple/Grolier American History Project
ABC NewsInteractive's *AIDS* video disc
ABC NewsInteractive's other titles
The Living Constitution (Apple Multimedia Lab with Optical Data Corp and Scholastic Inc.)
World Studies (IBM -- in development)
IBM Physics Discovery Series
Laws of Motion (EME)

MS/HS) *Ticket to Paris* (Blue Lion Software)

The Visual Almanac (Apple Multimedia Lab)
Voyager Corp Music CD-ROM's such as *Beethoven*
Audio Notes series (Warner New Media)
Anatomist (Educorp)
Life Story (Apple Multimedia Lab with Smithsonian and Lucasfilm)
Grapevine
Culture 1.1 (Cultural Resources)
Presidential Election of 1912 (Eastgate Systems)
TimeTable of History (Xiphias)
Illuminated Books and Manuscripts (IBM)

HS) (A selection from the EDUCOM/NCRIPTAL Awards)
The Would-Be Gentleman (Stanford University)
Social Power (University of Minnesota)
The Safe Affair (University of Michigan)
CompuGraph v. Chang (Harvard Law School)
Graphs and Tracks (Carnegie Mellon University)
Good Graphs! (Youngstown State University)
MicroCalc (University of Michigan)
Introduction to Statistics (University of Delaware)
Spanish Microtutor (University of North Carolina)
Witches, History, and Microcomputers (Tulane University)
Chemical Reactions (University of Illinois)

2) Access to Multimedia Materials

CEL *Video Encyclopedia of the 20th Century*

CD-ROM's:

Compton's MultiMedia Encyclopedia
Grolier Electronic Encyclopedia
Electromap World Atlas
Languages of the World
Oxford English Dictionary
U.S. History on CD-ROM

3) On-Line Databases and Telecommunications

XPRESS•XCHANGE
Dialog

Compuserv
Dow Jones News/Retrieval System
GEMNET's Global Information Network
Earth Lab (Bank Street)
The Bank Street Exchange
The Source

Support Staff

First Program	Logo educator, familiar with early childhood software keyboarding software.
Middle School	Grades four and five: one language arts teacher fluent in word processing and writing process. One computer math person. One Middle School computer support person for faculty. Available to help faculty learn new configurations, there when machines do not work. Explores software/hardware with faculty, computer preceptorial for faculty and students in classroom. (No Lab supervision.) Perhaps teaches a computer applications class.
High School	Similar duties to those Middle School support person, but supervises Lab(s), teaches computer competency course. (May be shared by more than one individual and combined with New Lab responsibilities.) Additional computer science teacher.

Much like a small town, the school as a technologically equipped information landscape cannot come to life until it becomes populated by users who feel at home in it. As the community settles and grows in that environment, more users become guides and blaze new trails that add meaning to the landscape, which makes the landscape more attractive to newcomers. The human factor is what makes the difference here, because we tend to trust people more than machines.

Faculty and students will assume a number of roles:

System operator, computer support person, New Lab personnel -- who will provide general services to help connect users with what they are looking for.

Specialists and content experts -- who will concentrate on specific subject areas and particular software programs.

Interdisciplinary users -- who will provide commentary and criticism.

Other users -- who will share tips as to use.

Faculty

It is precisely this group that we wish to grapple with the nitty-gritty of applications development. We need to focus our attention on ways to merge the power and potential of new technologies with the power and potential of the teacher. Using the Middle School as an example, I propose three ingredients that would help to bring this about:

1) Technology Experts

New Lab personnel, language arts teacher fluent in word processing and writing process, computer math person, computer support person. Provide faculty with the resources, both technological and human -- that will be of assistance in introducing multimedia technology into the classroom. These individuals will both demonstrate technologies and tools that are currently available and help faculty learn to exploit hardware and software configurations.

2) SWAT (Sharing With Applied Technology) Teams

Teams need to be put together that combine the resources of available time, computer expertise, disciplinary expertise, and teaching expertise. Each faculty team will be responsible for the development of applications in their educational environment. This will be understood as a part of their teaching assignment. (In the short term, we could support such efforts with mini-grants taken from the Director's discretionary portion of the Tishman Project.) The team will include a faculty member or members and a technical support person (computer support person or New Lab personnel).

We must move from isolated experiments to organizational commitment. We must move from the independent activities of early adopters to the integration of these activities into the school community. Many of our initial accomplishments are due in large part to the significant efforts of individual faculty members (with New Lab support). While such individual efforts are an important source of energy for innovation, they may at the same time limit their ultimate success. Middle School teams (and High School departments) can play an important role here by pulling innovation into the organizational context, building a grade level or departmental base for it, and making it less egocentric and more collaborative.

3) Computer Classrooms

Each Middle School student and faculty member will have access to computers in her classrooms. In the past, to teach computer programming and literacy, we grouped all of our computers in one or two rooms. This practice was fine for teaching about computers, but is having 15 computers in one lone room the best way to use computers to aid in writing instruction? We must place computers in classrooms for use by teachers and students when they are being used as part of regular instruction. Having two to eight computers located in the classroom is a more comfortable setting for both teacher and student and is a more natural way to integrate their use. Yes, it means that the computers may not be used each minute of every day, but we should stop looking at computers as scarce resources. More importantly, it means that teachers and students will use the computers when it is appropriate to use them. They will use them much more in the comfort of their own classroom than if they must trek to computer labs.

Keyboarding, Word Processing, and Writing

In a few decades, keyboarding skills may be as obsolete as proper buggy whip techniques are today. However, until that time, keyboarding must be considered an essential transitional skill that all students should master in order to communicate with machines. (OK, Susan, I've changed my mind on this one!) To wait until the middle grades to teach keyboarding skills risks that students will learn hunt-and-peck techniques that will be extremely difficult to extinguish at a later date. The appropriate time for introducing keyboarding skills should be seen less as a function of age or grade level than the student's need for the skill. There seems to be little point in teaching a skill that students will not have the opportunity to practice in a meaningful way.

Keyboarding software on the market runs the gamut from arcade style drill designed to improve the speed of individuals who already have keyboarding skills to complete packages that begin with the correct placement of the fingers on the keyboard. I list some below, beginning with a keyboard familiarization program.

The Friendly Computer (MECC)
Type to Learn (Sunburst)
The Wonderful World of Paws (Southwestern Publishing)
type! (Broderbund)
Tut's Typer (Roger Wagner Publishing Company)
Mavis Beacon Teaches Typing (Software Toolworks)

Writing classrooms that use computers with word processing programs are a great improvement for teaching students how to write. They are hardly an innovative development. What's surprising about technologically equipped writing classrooms is that they are seen as new. They should have been installed years ago. When writing things out in longhand is compared with typing them on a computer keyboard, keyboard work wins hands down. If a student's writing rate can be improved by 300 to 500 percent, to say nothing of the editing power available, how is it possible that keyboarding and word processing weren't immediately accepted?

What is the computer's unique contribution to the educational environment? First, and most frequently mentioned, is the computer's role as a tool. Word processors reduce the pain of editing and revision, allowing students to format their work, produce professional-looking copies of text, and easily read their own and others pieces by eliminating problems of illegibility.

Spelling checkers help students make their final drafts more readable, and on-line thesauruses provide resources for students searching for more precise words. I would like to begin to use outline processors, programs that allow students to compose and manipulate an outline before and during writing. We could also utilize more sophisticated writing tools such as on-line dictionaries, multimedia dictionaries and complete grammar checkers.

It turns out, however, that word processing on computers, in addition to being writing tools, can themselves create and modify social environments. This is especially true for a subject such as writing, in which the social environment is central to both the learning process and the subject matter. The word processing I envision in the school includes both writing tools and writing environments. The general word processor would contain all the standard word processing capabilities, e.g., add, delete, replace, and search. (It would also be useful to have a facility for reformatting a paragraph of text into individual sentences so that errors of capitalization, punctuation, and structure would be more visible.)

The writing environment, however, would also consist of three other elements. Students would have access to a *planner* -- a tool that helps students become more organized and efficient in their writing. The planner would help students (1) generate and organize ideas for their writing and (2) reflect on their writing as it takes shape.

Students would also make use of a writing *library*, creating an environment that enables students and teachers to share information and compositions. Students and teachers would store their writing in the library so it would be available to other computer users. Thus, the library would perform three major functions:

1) It would create a communication environment in which students are encouraged to write for their peers as well as for the teacher.
2) It would organize writing in different ways.
3) It would provide easy access to stored pieces of writing.

There would also be a *mail* facility, allowing for direct communication among individual students, groups of students, and teachers. It would combine features of the post office, the telephone, and a bulletin board in that written messages could be sent between individuals or a message could be posted for a group.

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Computer Science & Computer Competency in the High School:
Judith Sheridan
High School Director

Introduction

With the proliferation of computers and courses that rely heavily on computers as a central tool for knowing and for exploration, in October, 1991, a series of meetings began that included Frank Moretti, the Divisional Directors, Tishman Project advisors, Robbie McClintock, Luyen Chou, Rachel Bellamy, Bruce Long, and Chuck Rice (senior teacher in computer science in the High School). They met to attempt to define expectations regarding student computer competency in each division. These meetings were held throughout the academic year, and culminated for the High School with a redefinition, more options from which students could fulfill what had become the computer science requirement.

Clearly Dalton's commitment to educating students to employ the vast potential of computer technology in a *creative, active way* initially led to the creation of the computer science requirement. Increasingly computer technology was being employed in a complex manner in courses outside of the computer science department, most especially Malcolm Thompson's Astronomy course, Luyen Chou's Civil War course and David DeSantis' Physics course. At the same time offerings in foreign language and the visual arts were being planned that promised to go beyond the mere application of programs into the realm of problem solving and program design. The committee believed, that for most of the students, learning about computers and programming as an end alone was less effective than learning about computers in a scientific, artistic or humanities context. At the same time a computer science program should exist for students inspired to go on to gain greater depth in the area of computer science. The feeling was that more students would go on to study computer science, perhaps through to the advanced placement level presently offered in the high school, if their initial introduction was in course work found throughout the curriculum in both the High School and the Middle School.

Components of the new requirement

After many discussions a list of skills that would define the new requirement emerged:

1) *Secure knowledge of word processing*. Students are required to know at least one word processing program and all its functions: moving texts, copying, footnoting, moving between documents, and search and merge functions. For most of our students this skill can be confirmed by middle school teachers. For those who need instruction, the preceptors working in the preceptorial lab that will be outfitted with networked computers can instruct new students in the ninth grade. These students are required to enroll in either study skills or writing workshop.
2) *Secure knowledge of how to use spread sheet and data base programs*. These devices are used to test hypotheses and/or predictions. Use of spreadsheet and knowledge of collection and analysis of data are a part of many courses in the High School science and math program, and promise in the future to be a part of history and courses that employ statistics.
3) *Secure knowledge of computers as a communication tool*. Students who participate in collaborative projects that require networking will meet this requirement.
4) *Knowledge of information data structuring*. Students will be required to understand the logic of how data is ordered and how to add information that will be accessible to data bank.
5) *Knowledge of graphics, the drawing of graphs and charts*. This will be a part of any course that incorporates statistics.
6) *Knowledge of algorithms as a way to solve mathematical problems*. A unit or units that introduce algorithmic problem solving in the mathematics and science curriculum will be required.
7) *Knowledge of the computer to solve problems by employing programming skills*. This last item is the most complex. There are many computer languages that enable students to program creatively and to design applications in order to achieve the solution of problems in many fields of study.

Computer requirement for the academic year 1992-93

Next year students may fulfill the computer science requirement through a variety of course offerings:

1) By completing a computer science course.
2) By taking courses in Astronomy, Physics and Civil War, and fulfilling the extra assignments decided by the instructors of those courses.
3) By taking a computer science application course such as Linguistics with computer science applications.

Purpose of the new computer requirement:

The hope of the new requirement is to introduce students to this powerful tool in the context of their studies, not as a course of study that is tangential. In the future more courses will be listed as meeting the requirement. It is easy to foresee a time when the requirement will be met as a matter of course, as is reading and writing, and not be listed as a special concern. At the same time computer science offerings should remain strong as students are drawn to this field by an authentic desire to learn more, not by the constraint of a requirement.

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The Dalton Network and Multimedia Library

The Cumulative Curriculum and Networked Multimedia:
Robert McClintock
Co-Director of the Tishman Project

Educational Design of Learning Environments

> Excerpted from *The Cumulative Curriculum: Multimedia and the Making of a New Educational System.* New York: Institute for Learning Technologies, 1990. pp. 21-32, 81-87.

Education has a setting. In a print-based culture, the setting is the age-graded classroom where lessons unfold according to the time constraints of the standard instructional period. We seek, first, to rethink the organization of educational space and time in light of the possibilities of advanced information technologies. This involves something much more basic than simply inquiring into the optimum size and configuration for a classroom in which students will use computing equipment.

> In building the *Dalton Network and Multimedia Library*, we seek to develop the technical and intellectual infrastructure for an education that better links culture and experience. It will be a long-term effort. Here are some important aspects of the task.

New technologies can alter the available ways for structuring educational space and time -- they can become resources in the educational design of learning environments. Currently, electronic mail is perhaps the most familiar example of this point, for it significantly alters the temporal frame within which consultations between students and teachers can take place and it may also subtly change the spatial requirements of exchange, diminishing the need for simultaneity in both time and space, as in face-to-face exchange, or even for simultaneity in time alone, as with telephone exchanges. An intensive, many-cycled give-and-take can occur without the parties needing to be synchronous either in time or space. Thus, the physical constraints impeding one-to-one consultation between a teacher and a student can be greatly lowered.

Very soon, however, information technologies may become even more powerful architectural resources, allowing a single space to serve multiple functions and different kinds of groupings by switching attentional foci electronically. Thus imagine a large rectangular space, twice as long as it is wide, suitable without crowding for about a hundred persons. When a very large screen at one end was active and all attended to it, the space would function as a large room for the whole group rather like a small auditorium. Imagine that the long walls were divided into four quarters, with a display screen on one wall in the first and third quarter and on the other in the second and fourth quarter. When those four screens were active, each with different material, the whole space would be divided into four sections, each with, say, twenty-four people. Retractable dividers, designed to provide simple visual and acoustic buffers, could easily strengthen that division. Imagine further that throughout the large room twenty-four well-designed display consoles were placed so that the students, in groups of four, could orient to the consoles when those were active, enabling the space to work well for small cooperative groups. Finally, equip each student with a notebook computer linked to a server by a radio coupling. When the screens of those individual machines were active, rather than those of the consoles or the display walls, each person would be in a somewhat private space within a large room, with each person going off according to his or her curiosity.

We offer this example, not to assert that it indicates the new design that should prevail, but to illustrate ways in which information technologies may make the definition of new forms of educational space and schedule possible. The existing forms of the age-graded classroom, functioning according to the standard period, do not adapt well to the use of powerful communication media. For instance, many feature films could be moving and illuminating educational tools, but they do not fit well into existing schools: neither is a classroom for twenty-five an optimum viewing space, nor is the 50-minute standard period a good time division within which to use such resources. Alternatives are possible that are currently unexplored.

Multimedia information technologies with powerful networking, tracking, and scheduling capacities can make the very flexible use of space and time possible. We plan to work closely with established and emergent schools that have the opportunity and capacity to experiment with such flexibilities. Our inquiry will proceed according to the basic principle that the new technologies provide resources with which space and time can be organized differently than it can be without those technologies. We are dealing with innovations that invalidate the common sense that held under prior conditions; our task will be to develop a new common sense, suitable for the new conditions. With the old common sense, educational environments were standardized and predictable; with the new, they will be flexible, diverse -- a challenge to the imagination.

Motivational Sources of Education

Think of a fifth-grade classroom. Imagine the class dealing with virtually any subject. The teacher has just provided an explanation of a key point summarized in the text. She asks a question -- some pupils raise their hands and wave eagerly, confident that they know the answer. Some sit in a studious effort to avoid attracting the teacher's attention, knowing that they do not know and not wanting that fact to be registered in the public knowledge of the teacher or the class. Others seem neither eager nor reluctant, they fidget, raise and lower a hand in ambivalence, thinking they know the answer but not being sure, wanting to earn the teacher's commendation, but fearing that, if wrong, they risk rejection or rebuke. These are the signs of instructional competition at work. From the early grades through the highest levels, the existing system motivates children by engaging them in a competitive effort to shine in recitation and examination, in which each tries to show that he or she has mastered better than others the information sanctioned to be fit for his or her level and to be correct in the view of academic authority. As a result of this reliance on competition, the educational system functions as a powerful sorting mechanism, and when it becomes clear to many that however they may try, they have lost the competition, they drop out.

It is remarkable how thoroughly existing educational systems, around the world, have been adapted to harness competitive motivations. It is very hard to find arrangements in schools that have been designed to encourage children to act from other motivational sources. Undoubtedly the reasons for this reliance are complex, and certainly one among them is the important fact that competition is a very powerful, effective motivator. But there are other powerful motivators, among them cooperation, and it is remarkable how few educational arrangements have been designed to motivate children to learn through cooperation. The reason for this imbalance between competition and cooperation may have had much to do with the logistics of working with printed information.

Think of a ninth-grade teacher, preparing a unit on feudalism, lamenting,

> I can't have them do group projects. There just aren't enough worthwhile materials reasonably available to them. New York City has all sorts of resources, but it doesn't really help -- those who would need to go to the Cloisters wouldn't be able to get there without all sorts of complications. The school library is good but inadequate and they can't just simply use the high-school annex to the New York Public Library -- we either stay in the school or arrange, all together, to take a trip. How do I get some to the Met, others to the Morgan, and a couple into the stacks at Butler Library? How can projects be done at a high academic level in a routine way?

If it is hard to do group projects at a high academic level in a routine way in New York City, it is far harder, most other places. Sadly, serious information management problems discourage inquiry and cooperative learning -- problems that must be solved if these alternatives to competitive learning are to become practical, everyday alternatives in mass education. Competitive motivation arises when a group of students start from an appropriately equivalent basis, usually as measured by age, and each is then asked to master a limited, standardized body of material, with goods -- praise, grades, promotion, and acceptance by the college of choice -- being distributed in proportion to how well, in comparison to others, each performs. From the point of view of information management, this practice is very efficient; it is essential in establishing the comparison that all work with the same body of subject matter. This creates a large market for inexpensive, well-chosen, clearly-presented selections, which textbook publishers compete to provide.

Cooperative learning does not make sense in situations where each student starts with the same content and with the goal of mastering more of it than anyone else. Cooperation aims at having participants do different things and then coordinating their accomplishments in a common achievement that exceeds what each would manage alone. In educational situations this puts far greater strain on the information resources available to the cooperating participants. Ideally, for robust cooperative learning, students should face an expansive horizon of questions, armed with extensive resources to pursue their inquiries in many directions to considerable depth. If the questions and resources available are limited, their cooperative effort will not make much sense and different members of the group will find themselves working at cross-purposes with each other, repeating each others' efforts, and vying with one another to do the most with the few resources on which all converge.

For centuries, educational reformers have contended that cooperative learning would be a good thing, and occasional examples of learning by working together to solve real problems keep the ideal alive. It has been very hard, however, to provide the intellectual resources to sustain good cooperative learning in most educational settings. The practice has worked best with the very young, where relatively limited materials will sustain the effort, or at the most elite levels of education where bountiful laboratories and libraries sustain the extensive specialization of inquiry that cooperative learning generates. For the age between these extremes, cooperative learning has been very difficult to implement. What materials will be needed to have twenty fifteen-year-olds do a two-week unit on feudalism according to the principles of competitive motivation? Each will need a copy of a well-written text and regular attendance to a teacher who can provide supplemental explanations and manage recitations and a test. What materials will be needed to have those students spend two weeks cooperatively exploring the history of feudalism, drawing together at the end a presentation of their results? The range of possibly pertinent materials is nearly limitless and the possible roles a teacher might take in the effort is almost boundless. Consequently, the information logistics of cooperative learning strain the print-based system.

Electronic information management technologies will significantly alter the logistical constraints on cooperative learning. One of the simplest examples of such change involves the problem of movement. Traditionally, inquiry meant that children had to leave the classroom to go to the library or other locations of specialized resources. This usually was not efficient, introducing confusion about who was where and wasting time in excess movement. With inquiry in a well-networked electronic environment, the children can access specialized resources, almost instantaneously, with very little waste of time or effort. Such changes in logistics can have profound effects on the experience of working together. Traditionally a simple decision -- "I'll get this and you get that" -- would draw a cooperating pair apart, often to quite different locations, perhaps with one getting stymied on the way. In an electronic environment of information management, the two can allocate their effort while remaining in close proximity, physically and intellectually, often checking on the implications of what each is finding for the other.

We propose to study how to implement multimedia information resources in an educational environment in order to enhance the available range of educational motivation.

- How should systems be implemented to support cooperative inquiry?
- What groupings relative to different subjects and ages work best?
- How should teachers assess performance in cooperative settings?
- How should curriculum designers organize knowledge and tools of inquiry and expression in order to support learning by the members of study groups?

These, and many similar questions, need serious examination in order to broaden the motivational energies effectively harnessed in a technology-intensive educational system.

Organizing Culture and Knowledge

We speak of the print-based school because printed materials have been the main medium for making culture and knowledge accessible to students. So long as there has been no alternative to this reliance on printed materials, educators have paid close attention to the pedagogical features of one text compared to another, but there has been little attention to the pedagogical character of printed text, per se.

If we inquire into this latter matter, we see that the logistics of working with printed texts have much to do with the sequential character of the existing curriculum. Developmental psychologies delineated the sequences of major stages in the child's growth. But educators should not exaggerate the degree to which curricular sequences, differentiated by year and by subject, have arisen by rationally adapting curriculum and instruction to children's developmental needs. That world history should be a tenth-grade subject and American history a eleventh-grade one, or that biology should precede, or follow, physics or geology has little to do with the developmental characteristics of children. It is largely a conventional solution, one among many, arising from the need to divide the curriculum up into discrete subjects that can be presented in some sequence. The need for sequence is inherent in the constraints of print, not those of psychology. And whether it should be this sequence or that sequence is comparatively an inconsequential question.

What does it mean to move from fifth to sixth grade? A child who does so usually changes teachers and rooms, sometimes even a building, but these are not the essential changes -- the child could move from fifth to sixth grade while staying with the same teacher in the same room. What changes from one grade to the next is the curriculum, and most importantly the set of textbooks the pupils use. Sixth-grade texts differ from fifth-grade texts and so on and as the child progresses through school he or she does not cumulatively carry the texts from prior grades around. Educators have long likened the curriculum or sequence of grades to a ladder or staircase because the sequence of texts are like the sequence of rungs upon the ladder: one climbs from rung to rung, leaving the last one behind. Students in any particular grade find it hard to regain access to the materials studied in prior grades, without somehow going backwards, and they find it even harder to anticipate access to materials slotted for grades higher up. Unable to move easily, back and forth, pupils experience the curriculum as a set of sequential studies. The costs are high. If a pupil did not get one part of the sequence, the omission can be portentous, not because the sequence is the only way things could be reasonably mastered, but because, once missed, the opportunity to make it up may be very hard to regain.

Pupils will have a very different relation to a computer-based curriculum, assuming that the whole body of culture and knowledge relevant in education has been integrated into a comprehensive system, any element of which they can access at any time from any place in the school. With continuous and ubiquitous availability, the sequence of grades would loose much of its meaning and study would be experienced as a cumulative effort.

We propose to investigate how the subject-matter appropriate for a complete and excellent education can best be organized, making no assumptions about the year-by-year sequencing of its presentation. A smart, computer-based curriculum should be able to sustain an infinite number of paths through it, and it should be able to provide each student with clear reports about what he or she has so far covered, regardless of the path and sequence he or she has taken. With such resources, we will ask questions such as these:

- What technological resources will best make all the knowledge, skills, and ideas in the curriculum continuously available to all students at all times?
- If the subjects of the curriculum become more cumulative, will the mix of activities that are useful to students change, and if so, how?

- Will there be a set of essentials, that must be mastered in a mandatory sequence, with the new system, and if so, how will this component of the curriculum relate to less sequential, less mandatory parts?
- What will happen to distinctions between subject-matter areas if all components of the curriculum are accessible to all students at all times?
- What tools of access, orientation, and expression will be needed by students to sustain their work with such a comprehensive curriculum?

Our main task will be to prototype a cumulative multimedia curriculum, one with a comprehensive selection of materials in it all of which will be accessible to all students at all times. We will implement this curriculum in working educational settings and pursue answers to questions like those above through intensive participant observation in these sites. In a nutshell, this set of activities defines our research agenda.

In addition to potentially making the content of the curriculum accessible to children in a much more cumulative way, we should note another, profoundly important structural effect on subject-matter that the new technologies will have. For five centuries, written materials have been the main channels of access to culturally significant knowledge. This dominance of written communication arose because printed texts developed a level of accessibility radically different from other modes of embodying cultural expression. Access to printed materials could be general, efficient, and enduring. Access to other forms of cultural embodiment was comparatively restricted, troublesome, and transient.

To grasp this point, consider the theater, the drama, and its place in education. Multimedia are not new. Their significance pedagogically has grown of late. One often encounters the text of Shakespeare's *Hamlet* and other great plays as works taught within the curriculum. Productions of one or another play may be significant extracurricular activities in schools, and students may be encouraged to see a professional staging of them, should such performances be accessible in their locale. Nevertheless, the performances, whether student produced or professionally produced, have not been the central educational use of the drama during the era of print because access to the performance has been highly idiosyncratic and temporary, whereas access to the text of the play would be general and enduring. In the era of print, written materials have dominated educational effort from the most elementary to the most advanced levels because these have been the materials to which access has been general, efficient, and enduring.[1] A radical departure is afoot because now electronic information technologies can provide general, efficient, and enduring access to a much broader range of culturally significant materials: recorded performances of the play can be as easily retrieved as its text. The educational consequences of this development will be vast.

Networked, multimedia electronic systems provide general, efficient, and enduring access to cultural works of nearly every form conceivable. In the era of print, written works had a superior cultural usefulness than other resources. People could distribute, store, cite, retrieve, and use printed resources far more effectively than they could work with other forms of cultural expression. Essentially, one has long been able to refer other people to printed materials without knowing the particular physical location of the particular instance of the material that people will consult, for one cites editions -- Plato, *The Republic*, Book IX, 592b -- the numerous instances of which are scattered at many places. Paintings, plays, sculptures, and buildings, in contrast, cannot be referenced in this generalized way -- they exist in unique locations and access to them can require taxing trips, even a pilgrimage. Owing to this superior accessibility, printed materials, usually written materials, have more and more mediated the production and communication of knowledge in modern culture. Let us sum up this development: in the era of print, *verbalization* increasingly dominated education.

Slowly through the twentieth century, and building rapidly at its

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[1] Engravings, woodcuts, and other forms of printed images are a partial exception to this assertion, except that accessing them requires one to manipulate the written language, not pictorial images. Thus, to retrieve pictures of Chartres Cathedral, one must use written catalogues and indexes.

end, other modes of exchanging information, ideas, and knowledge between people are gaining cultural power relative to printed text. For centuries, texts have been available "at any place at any time" -- that has been their power. With the rise of the broadcast media, first speech through radio and then the moving image through television gained part of the power of print, becoming available "at any place," provided one tuned in at the right time. The recording industry gave music full accessibility, independent of particular place and time. Video tape is giving the same to the moving image, and very soon, with fully interactive multimedia systems, the superior accessibility of text compared to other forms of expression will completely disappear.

When people speak about interactive, multimedia systems, they are speaking about a process by which the full gamut of human expression will integrate into one complex system, with all components, regardless of form, being generally, efficiently, and enduringly accessible. This integration, enhancing the accessibility of all forms of expression, we will call *visualization*. A powerful trend toward the visualization of education is taking hold. Its historic effect will be to broaden effective participation in the culture greatly.

"Verbalization" here refers not only to the spoken word, but even more essentially to the written word and even conceptualizations communicated through the symbolic notations of mathematics and the like. In its most comprehensive form, the basic proposition of verbalization is that higher-order thinking consists in manipulating symbolic notations. As we here use "verbalization" to describe far reaching assumptions about the relation between words and symbolic notations to higher-order thinking, so we here use "visualization" expansively to situate reflective thinking in pre-linguistic forms of perception and awareness, which may then be expressed through words and symbolic notations, or through images, sounds and all manner of associations and actions. In this sense, "visualization" is not a mere opposition to verbalization, not a simple alternative to it, but a Hegelian *Aufhebung* of it, the upheaval of it into something else in which the original form remains nevertheless included and preserved. "Visualization" in this extended sense includes "verbalization" as one among a number of different forms of reflective thinking, which all should be integrated into a comprehensive and many-sided culture and education.

We propose to investigate how to facilitate such visualization of education. This requires that we find how to create multimedia presentations and to stock the curriculum with them and to present the whole effectively to students. Such inquiry reaches very deeply into the basic assumptions about teaching and learning and educational common sense. Gone is the finite body of subject matter that should be teachable and that students can be held responsible for learning. The idea that good learning consists in apprehending what has been taught no longer will hold. With multifaceted curricular resources, which can sustain many valid paths of inquiry within them without any inquirer exhausting all their contents and permutations, one cannot specify precisely what has been taught. Hence, our effort also requires that we develop important new forms of evaluation. Verbalization pervades existing forms of evaluation, which usually test the recall of verbal information and assess students' capacities to express their ideas in writing. With extensive visualization in education, other ways of testing the results will become essential.

In sum, then, with the effort to develop a computer-based system of education, we not only need to explore new ways of organizing culture and knowledge, we need to recognize that we change fundamental assumptions about education by doing so. With the print-based system education has consisted primarily in imparting authoritative selections of material to students who are responsible for learning them. With the electronic system the scale of the authoritative selections of material jumps significantly and the student can no longer be held responsible for simply learning them in full. Instead the student becomes responsible for intelligently exploring them and taking from them a unique but sound and useful sampling. Formal learning thus becomes much closer to experiential learning. The student needs to become a skilled explorer, not a docile learner; the teacher becomes, not the master, but the native guide, like Vergil to Dante, interpreting, elucidating, cautioning, exhorting. We propose to try to uncover and understand such changes by implementing a prototype of the new system and attending closely to how it changes patterns of educational activity within it.

* * *

Equipment Needs

For several reasons, accurately estimating equipment costs is difficult. The project assumes the availability of a mature multi-media computing environment, when in fact that is still in the process of development. We know neither how quickly costs will drop with important items to levels that would pertain with full-scale production nor do we know precisely what developmental path certain technical possibilities will take. Further, we can only now guess what equipment we want, for the design and development work, through which we will decide on system specifications and the like, has still to be performed. All the same, we can provide general assumptions about what we will want and what will be available, and from that, we can tentatively itemize resources.

> McClintock wrote this description of equipment needs in early 1990 as part of a proposal to IBM University Relations. It still generically describes the type of installations we have been creating at Dalton. Specifically, however, the systems mentioned are no longer current with the market, and for the most part, we are using Apple, not IBM, equipment.

Let us begin with a statement of principle: the educational computing environment should be as functionally powerful as possible and as standard as possible. We are seeking, through this project, to substitute a cumulative curriculum for the sequential curriculum. It would run counter to the idea of the project to introduce a sequentially staged computing environment -- machines of small function for young children and progressively larger function as the children get older and more mature. Pages turn from right to left and lines read from left to right, top to bottom, within English language conventions, whether the reader is five, fifteen, or fifty. The adult user interface, the adult processing power, the adult repertoire of software, should be the interface, power, and repertoire for the child as well. Full-screen graphics take as many MIPs to generate for children as they do for adults; response delays are as distracting to the young as they are to the old. If the adept adult wants a computer at hand at all times, so too will the adept child. Standard, full-functioned technology should be the basis of technology-based education until we have clear evidence that some other norm, lesser or greater, makes better sense.

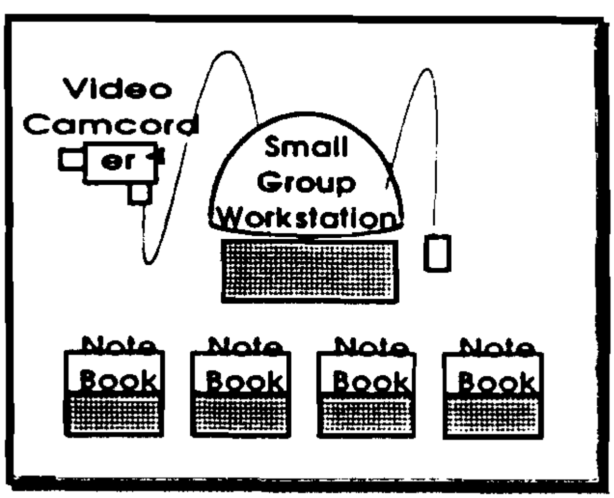
We specify a standard, full-functioned technology, not with respect to transition technology, but with respect to a mature computing environment. One cannot be sure what that will be. We will cope with this uncertainty in two ways, adopting what we call a "centrist" set of technical choices and moving in an anticipatory relation to the marketplace. We have just voiced the centrist doctrine: educational technology should broadly represent the main technological options in their most functional forms. Education, by its nature, needs to be representative, reflecting in its tools and substance the stuff of the culture. Educational technology needs to be used with special pedagogical intent, but at the same time, it should be acculturating, accustoming the young to the resources of thought and activity that they will be using throughout life. Were an educational technology to consist primarily in esoteric implementations, it would not serve well this acculturating role.

Our second way of coping with the uncertainty over what the mature computing environment will be involves making anticipatory choices relative to the market. We do not seek to be a Media Lab, exploring imaginable educational technologies with no attention to whether they will ever come to market. Equally, we do not seek to function as a training institute, giving hands-on experience with the current repertoire of established products. Rather, we seek to develop the cumulative curriculum in anticipation of the market, using technologies that have been shown feasible and have entered into development for the marketplace. DV-I, Digital Video-Interactive, is a good example: development systems are available at a market premium with the expectation that a new implementation will become widely available starting in 1993 or so.

By remaining centrist and in anticipation of the market, we should be able to develop the cumulative curriculum while moving toward a mature technology environment, remaining uncertain about exactly when the plateau of functionality will be reached, but being relatively secure that we will not have staked our designs on technological assumptions that must be discarded, along with the work and investment premised on them.

With these principles in mind, let us start making a preliminary specification of technology so that we can estimate the equipment needs of the project. We will proceed from two directions, one beginning with the immediate technical environment to be available to the student, the other with the school level system support needed to sustain it. Here is a sketch representing a small-group workstation, four notebook computers, and a video camera. We guess that four is the right size for the small group -- it might prove that two, three, or even five or more is better, but let us assume four for the purposes of estimating equipment. We leave unclear exactly how the notebook computers will connect to the small-group workstations, and those to the school server, although such connections will be necessary. Here are tentative specifications of each component.

- **Small-group workstation**. This should be a PS2/Model 80, running at least a 386 CPU and co-processor at 25 megahertz, with both DV-I compression and decompression capacity (or its equivalent), 8 to 16 meg of RAM, a 300+ megabyte fixed disk, and an 8514 color monitor (or its equivalent). The system should work as a server for the student's notebook computers, with the capacity for han-



capacity for handling up to six at once, preferably with a radio or microwave linkage. The small-group workstation would serve as a multi-media display and editing terminal and as a locus for integrating work that each student performs on his or her notebook computer. It would be the prime focus for their cooperative activities and a channel of exchange between the group and teachers and other groups. Each student would also have his or her disk directories here.

- **Notebook Computers**. Each student should have his or her notebook computer, which should weigh under 5 pounds, and have a 386 CPU, a fine resolution dark on white VGA screen, 8 meg RAM that will not go dead when the notebook is powered down, a full functioned keyboard and a pointer device: mouse, trackball, or equivalent. A LAN interface to the small-group workstation should be easy to connect and disconnect and ample, non-volatile RAM should take the place of disk drives with permanent mass storage being on the small-group workstation and accessible from a variety of locations over the school network. The notebook computers should allow students to be mobile while having easy access to their basic computing resources. Ideally, the notebook should be the one "book" that goes with the student anywhere and everywhere. Design work will need to be done to make the notebooks unobtrusively secure from loss or theft, and if that cannot be done effectively, restrictions on the notebooks' mobility will need to be instituted. Whether or not DV-I decompression chips should be on the notebooks depends largely on the progress of flat screen technology.
- **Video Camcorder**. This should be an 8-millimeter or VHS camcorder normally set adjacent to the small-group workstation monitor, feeding directly into the DV-I compression board so that it can provide a video component to e-mail. Additionally, students should be able to take the camcorder to other locations. The small-group workstation will serve as a digital video editing console and video input for presentations and study sessions should come to the workstation from the camcorder and from the central system repository over the network.

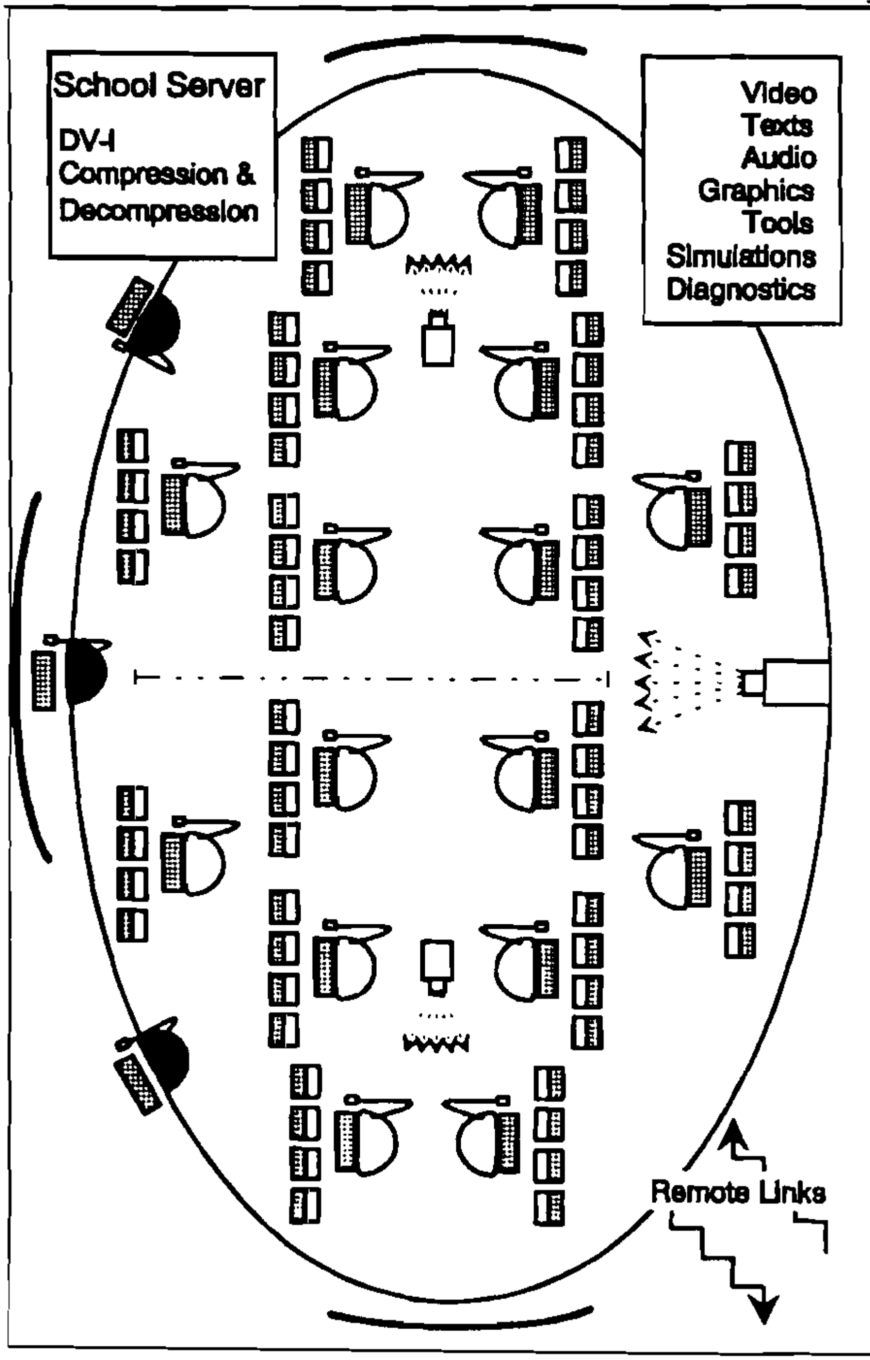
A rather sophisticated central system should support this immediate technical environment for students. The schematic diagram that follows represents a school server system surrounding sixteen small-group workstations, with three teacher workstations on it, one large video display for the whole group, and two smaller projection video systems for smaller groups.

The diagram additionally shows remote links, out and in. The proportional relation -- 4 to a workstation, 64 students as the full group, 32 to the sub-groups, one teacher to twenty some students -- are very approximate, determined more by the constraints of the page on which the diagram appears than by design and planning for real situations. The diagram, however, allows us to define components and their relations. We need a large, interactive video display for the whole group, intermediate interactive displays for sub-groups, teacher workstations with essentially the same functionality as the small-group workstations, a large system server that will store and manage the Cumulative Multi-media Curriculum, and dial-in/dial-out capacities available over the network.

- **Central Server System.** This should be a high-speed, high-capacity server. We want to tailor it to the needs of the Cumulative Multi-media Curriculum, not the other way around. By and large, all the special purpose storage and retrieval peripherals needed to support the curriculum should attach through this server. Through it, we want to manage an extensive video library, stored probably on standard analog tapes, accessible remotely through a jukebox system, with requested material digitized and compressed through DV-I real-time mode and sent over the network to the requesting workstation. Some video material may have been pre-compressed and stored on CD-ROM or on DAT. In addition to a video library, we expect the server to manage a large library of texts and images, much of it on CD-ROM's accessible through a jukebox, and other frequently called parts of the library on high-speed magnetic disks.

workstations should have the capacity to mirror what is happening on any other workstation on the system and to work in parallel with it. Further, a teacher should be able to manage the flow of information between the system server and other workstations from a teacher workstation, to make sure that specific materials needed to sustain small-group projects and the like are properly disseminated over the system. Finally, each should have a page scanner with OCR software such as OmniPage and a laser pageprinter for output.

- **Video Displays**. These will be important components of the Cumulative Multi-media Curriculum. Genuine multi-media needs to preserve the power of sustained, sequential presentations such as well-crafted films. These are usually best experienced in groups -- all, some, and many. Projection monitor systems that permit all to be one audience and intermediate groups to cohere as audiences should be under the control of the teacher workstations, with aggregate input -- group polling and the like -- possible from each student's notebook.
- **Remote Links**. Dial-out capacities should provide access to services and information that may be needed on occasion but not as integral components of the Cumulative Multi-media Curriculum. In addition, these will be important for groups within one school to interact with students elsewhere. Dial-in capacities should support homework and e-mail exchanges outside of school hours, and they may be very important in facilitating system support and maintenance. Since the Cumulative Multi-media Curriculum will require a full-screen graphical user interface, which is too information intensive to work well over phone linkages, a sub-set of resources that can be used in character-based formats, will be tagged within the overall curriculum for remote access.


School Server
DV-I
Compression &
Decompression
Video
Texts
Audio
Graphics
Tools
Simulations
Diagnostics
Remote Links

* * *

The Dalton Network:
Robert Matsuoka
Manager, Dalton Network and Multimedia Library
October 26, 1992

I. Introduction

Implementation of Dalton's local area network has gone through three distinct phases: installation of an Appleshare/localtalk network, installation of a Novell/token-ring network, and subsequent reconfiguration and expansion of the token-ring network. The configuration as it now stands is considerably more robust and capable than its predecessors, and will most likely remain unchanged in its basic form for the next few years. This report provides an overview of the structure of this network and describes its capabilities.

2. Topology

The Dalton LAN consists of two network topologies, localtalk and token-ring, routed together in various locations and accessible by 34 different rooms on floors 1-12 of the 89th Street building. The localtalk network runs over 256 Kbit/second twisted-pair phone cabling. Round wire phone cabling runs from the tenth floor mezzanine to the fifth floor and is accessible by a limited number of classrooms, where modular connectors have been installed. Due to its limited data transmission bandwidth, the localtalk system is used primarily to connect printers to the network.

16 Mbit/second shielded twisted pair (STP) token-rings provide most of the connectivity in the 89th Street building. The original scheme, implemented on a trial basis, consisted of a single ring running from the tenth floor mezzanine to the third floor. Over the summer, this configuration was enhanced by splitting the ring into 4 segments bridged together by the primary file server in room 1002 and doubling the number of rooms with network connections. In addition, all vertical cable segments were installed in conduit and most of the horizontal segments were relocated above ceiling tiles. The standard classroom arrangement consists of an 8-port Multi-station Access Unit, or MAU (a device which allows computers to be attached to, or removed from, the network without adversely

affecting its performance) connecting up to 8 Macintosh or IBM-compatible computers. Since only 33 MAUs may be attached to any single token-ring, increasing the number of ring segments also offers the potential for adding at least one MAU in every classroom.

3. File Servers

The primary network storage unit is an Everex Megacube 486-33 EISA machine located in room 1002. It is currently capable of up to 4 gigabytes of on-line storage. This machine also acts as the primary router/bridge, connecting the token-rings (for floors 1-4, 5-8, and 8-11) and the localtalk networks together. In addition, the file server has a 2 gigabyte on-line DAT tape backup unit. The file server is running 100-user licenses of Novell Netware 3.11 and NW-Mac 3.01. At the moment, nearly 300 faculty, staff and students have accounts on the file server -- as the year progresses, we expect that number to double.

A second file server, located on the 12th floor development lab, will bridge together an additional token ring. Plans are also under way to provide 2 dial-in/dial-out channels for the network. Specialized servers will also be added, allowing school-wide access to selected CD-ROM's as well as school-wide and external access to electronic mail and an electronic bulletin board system.

Our network typology and server capacity can expand easily. We expect network use to increase as a result of wider general use through the school and increased use of network-based software in the classroom. Ducting is in place for more token-rings as they may be needed and we can add additional servers to offset increased file-serving requirements.

4. Printing

Network plans call for school-wide access to 8 laser printers, 12 ink jet (color as well as black and white) printers, one plotter, and a number of dot-matrix printers. The laser printers will be situated strategically throughout the building for the greatest possible access by students and staff. Ink jet printers will be located in classrooms with a concentration of computers. The plotter will be located in the Multimedia Studio, a brand new facility on the 11th floor.

5. Miscellaneous Peripherals

Dalton students, faculty and staff will also have access to scanners, CD-ROM drives, large capacity removable media drives, laserdisk players, and video and sound digitizers.

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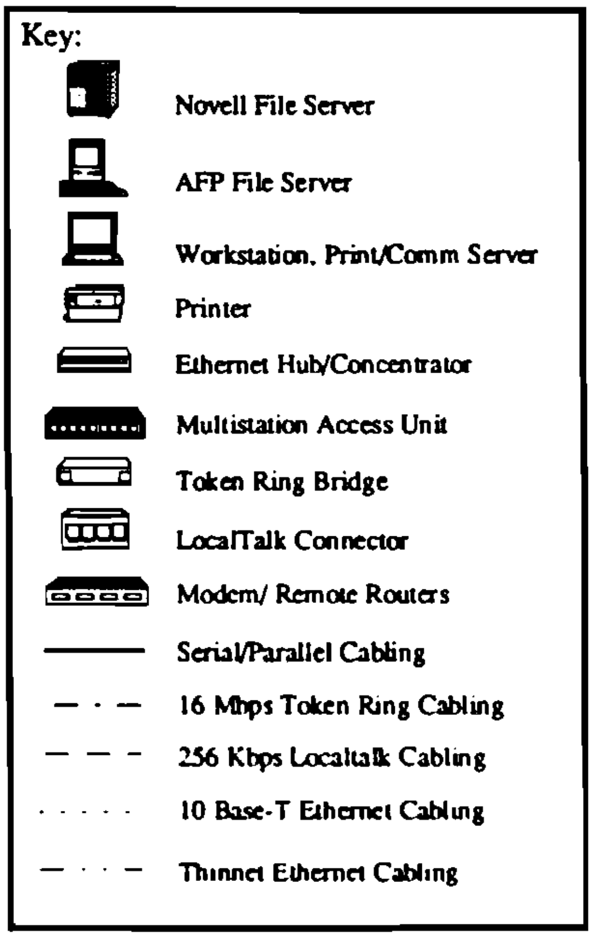
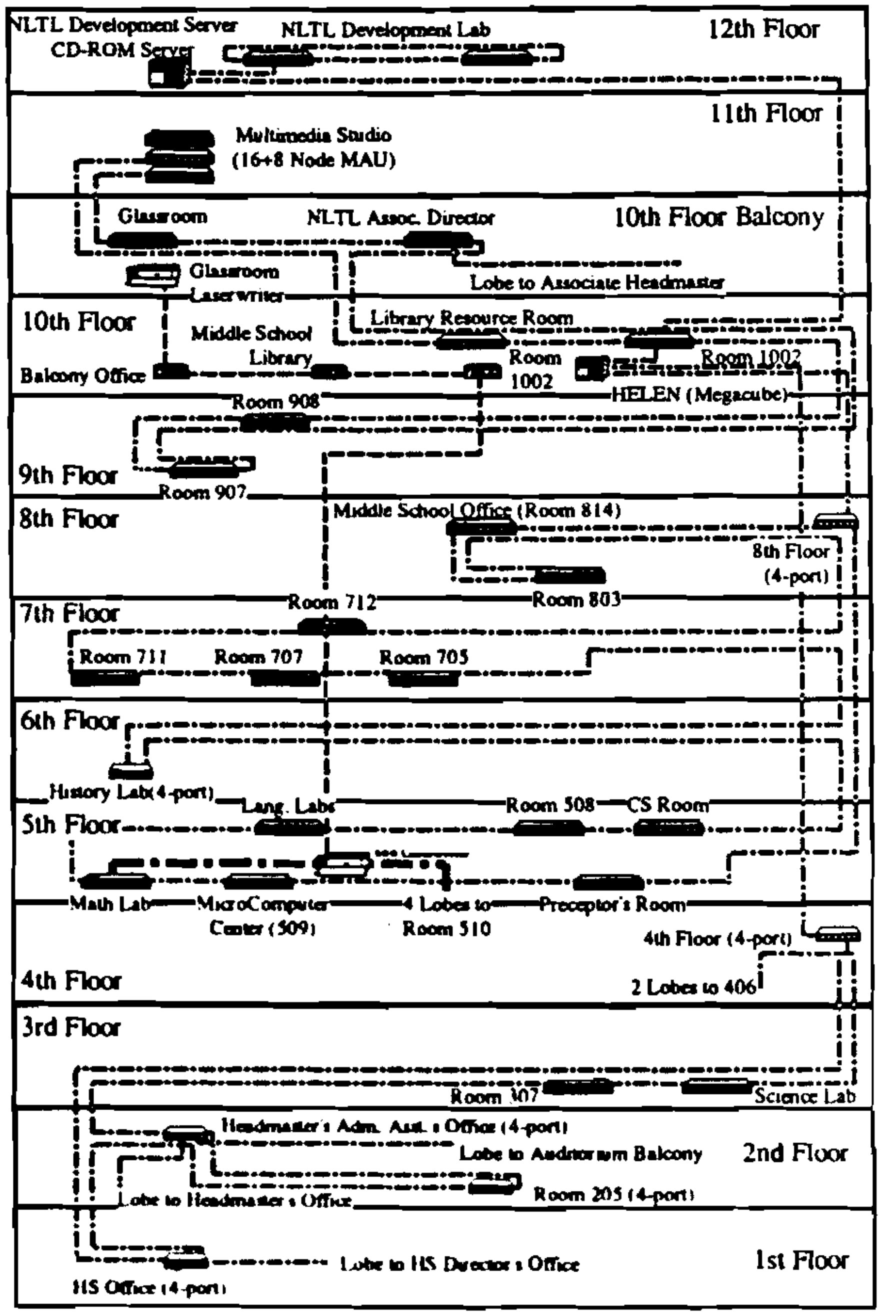
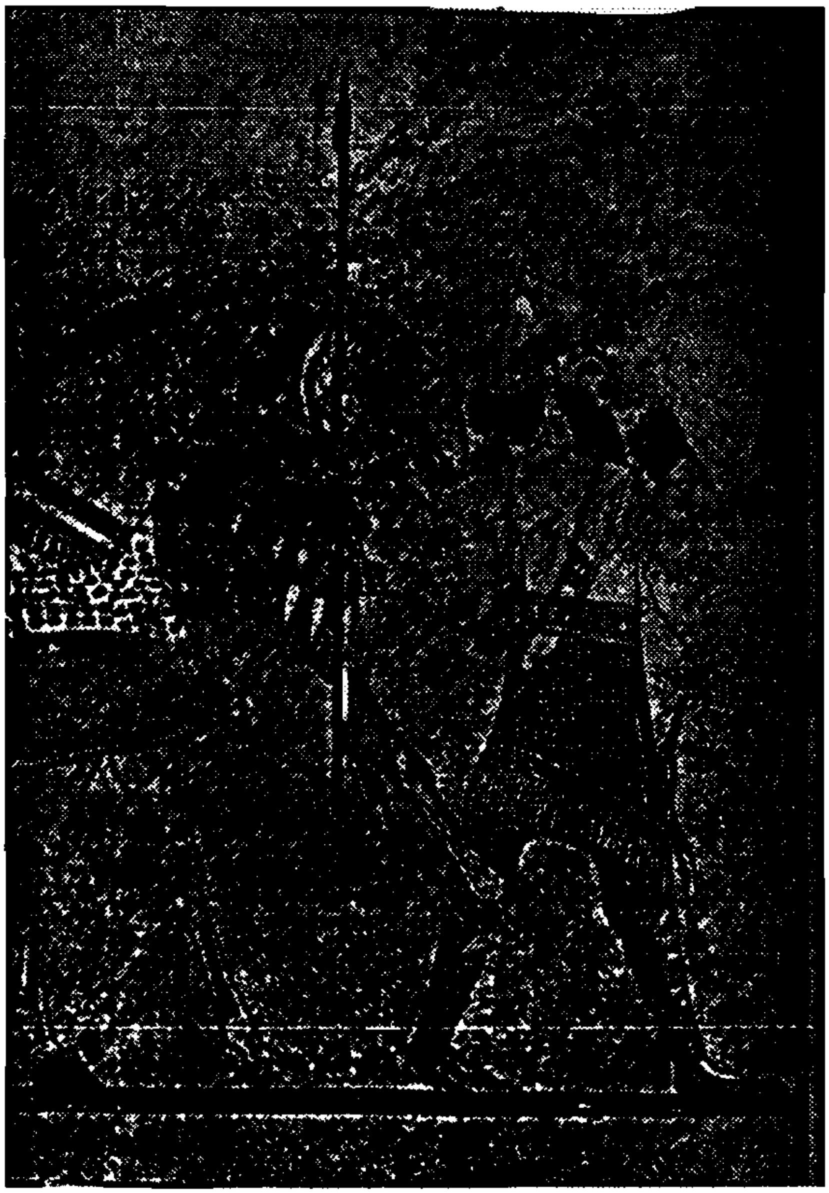


The Dalton LAN -- 89th Street Building





The First Program

The First Program: Retrospect and Prospect:

Karen Bass
First Program Technology Coordinator
Eileen Gumport
Design Associate

Members of the First Program New Lab Team have met to discuss the educational importance of technology based activities, and ways in which these can be implemented into the First Program. We would like to review activities for 1991-92, to propose a plan for a multimedia environment, and to suggest some grade-level activities. Included in this proposal are the related topics of hardware, software, faculty training and support.

The proposal meets two essential and inter-related goals for the New Lab at the First Program: to design an environment in which curricular areas are enhanced by new technology, benefiting both students and teachers; and to prepare First Program students for the multimedia technology they will encounter in future experiences.

It is important that the New Lab staff build a close working relationship with First Program faculty. Most academic work takes place within the House. We are prepared to become familiar with individual class curricula in order to help integrate computers into the students' daily lives.

In addition, we have attached current hardware and software inventories, including what software has educational value.

First Program: Technology Implementation -- 1991-1992

During the school year 1991-1992, the New Lab began to introduce technology-based programs into the First Program. As the first phase of this plan, 10 Macs were placed in classroom settings. Printers were distributed so that there is approximately one for every two equipped sites. A variety of software was purchased to support immediate use of the computers. This included child-oriented word-processing and graphic programs which individual teachers immediately began to incorporate into their daily classroom activities.

With the presence of these new computers, there emerged an immediate imperative for support and teacher training. Therefore, time was spent with teachers in their respective classrooms, introducing them to computer skills and techniques to use with their students, and working with teachers and students to define a multimedia educational environment. The goal for this training was to develop teacher independence and to find new strategies for installed technologies. Topics for this training were as follows:

- Macintosh fundamentals
- features of specific software used by students
- appropriate pedagogical strategies
- computer uses for development of instructional materials
- trouble-shooting and care for hardware
- administrative applications.

It is our intention that these teachers will become leaders in helping to train the next wave of teachers. The individual training sessions proved to be invaluable, and will be continued throughout the current year with these initial teachers as co-presenters with New Lab staff. In addition to the topics mentioned above, we will add training on peripherals and network use, as these items become available within the First Program.

During the 1991-1992 school year, initial discussions about potential projects that would be uniquely appropriate to the First Program took place. We discovered that most elementary teaching and learning is already multimedia in nature. In this context, the computer can be seen as another tool, another means of extending the range of communication possibilities through out the curriculum. These discussion, and the hands-on teacher training, brought forth a multitude of ideas and interest. First Program teachers who expressed an interest in computers were encouraged to explore how they and their students can be involved in development of Tishman projects. Planning sessions took place, and teachers integrated the computer into their lessons. Below are some descriptions of these projects.

Third Grade Integration Of Computers With Archaeology Project

Karen Bass' third grade began the school year studying about water. Studies included: Where does water come from? How is water important to human life? How can we preserve our water supply? Can we substitute anything for water? What if our water stopped? The class visited the Central Park Reservoir and found the answers to many of these questions.

The 6 week archaeology unit had The New York Harbor as its site. A guest speaker from the Museum of Archaeology brought old maps of New York City and actual artifacts that were found in lower Manhattan. The class began to piece together what life was like many years ago. The students began their excavation and examined the artifacts found on each level. They drew pictures of the artifacts they found. Students discussed each level and then constructed murals to represent what they believed took place during that time period. Each group presented their mural with a detailed explanation.

In the next phase of the project the use of computers was incorporated in many different ways. The class made a list of possible research topics. Each student was able to choose his/her topic. The students were given the opportunity to gather information from many resources. During this time they were taught word processing and various tool programs. Most of the students learned *Microsoft Word* or *Bank Street Writer*. They learned how to create a file, save and retrieve a file, edit, and print a file. They used *Kid Pix*, *Mac Paint* or *Print Shop* to create their graphics. A booklet was assembled that included their research and pictures. Each child was given a copy of the book and created an individual cover. As a culminating activity students planned their own diorama time capsules. The poetry unit was enhanced by having the students choose an object from their time capsule and write a Haiku using their newly attained computer skills. Oral presentations then took place.

At the end of 6 weeks the class began to study the harbor with a concentration on the New York City Harbor. They discussed the history of the harbor. How the harbor was used for trade. Why the harbor was moved to Port Newark. The role the harbor plays in a community. A comparison of a United States harbor to a foreign harbor was made. The teachers worked diligently with the school's environmental consultant and with the Museum of Natural History consultant. The class took trips to the South Street Seaport, Ellis Island, a lighthouse and a Circle Line boat ride. Members of the U.S. Coast Guard came to the classroom as guest speakers. Current events relating to our topics of study were discussed. The use of technology in research projects continued to be integrated into these areas of study.

Second Grade Integration Of Computers With Class Study Of Rainforest

Julia Brush's second grade house incorporated the use of a piece of software called *Eco-Adventures in the Rainforest* with their social studies projects concentrating on the environment. The program was used at full class, small group, and individual levels. The program demands the use of additional research materials in order for the students to exploit the program's full potential. This program is geared toward older children; however, Julia Brush developed a plan of pairing her students which allowed an opportunity for peer instruction and communication.

Small Group HyperCard Use In Third Grade Classroom

A group of students in Frank Buffone's third grade class initiated a HyperCard project of their own design. In order to successfully complete their project, the classroom teacher and a member of the New Lab staff taught the students how to design, flowchart, and program their material using HyperCard. The finished program was presented to their fellow classmates, First Program teachers, and New Lab staff.

All of the students in this House learned word processing and to use a paint program in conjunction with their archaeological dig.

Kindergarten/First Grade Small Group Projects Using The Computer As A Resource For Student Self-Expression

As an end of the year project Mary Mellow's kindergarten and first grade students chose topics of interest to study on an individual or small group basis. Among the many activities centered on these topics was the use of computers as a resource for students' self-expression in integrated ways. The students learned to use *Kid Pix* to create their own graphics to illustrate their research.

Dynotype -- An Interactive Program For The Study Of Paleontology Designed For Kindergarten And First Grade Students

Two First Program teachers, Gail Healy (K) and Mary Mellow (K/1) initiated a project proposal for the study of paleontology. A plan was formulated to develop and implement an interactive program for the study of paleontology. This project will enable younger students to perform all the tasks of a paleontologist at an excavation.

Working with New Lab staff, the Project Personnel began discussions with selected advisors, including *Archaeotype* experts. Meetings took place on a regular basis to determine the format by which this material will be presented to the students. Research was carried out to locate and evaluate existing software pertinent to this area. Teachers began to assemble materials, e.g. dinosaur images, data relating to weight, height, diet, etc.. Stephanie Fins, Dalton Representative to the Museum of Natural History, arranged for exclusive Dalton access to specific fossil materials.

Over the summer the teachers continued to meet and prepare for this project. Selected material for use in the project was scanned and entered into the computer in database format. A survey of photographic and fossil materials in the Museum of Natural History was undertaken, and arrangements were made to meet with the paleontological staff at the institution.

Currently, the collected materials are being assembled into a working prototype. It is expected to be deployed in the classroom in the Spring of 1993.

First Program: Technology Prospects -- 1992-1993

The New Lab was recently awarded a first floor classroom at the 91st Street building. It is located at the end of the school's lobby, joined by an open doorway, making it highly visible from the much frequented reception area. The space is in the process of being renovated to accommodate the hardware needs of up to 12 workstations. This will allow New Lab staff and First Program faculty to work with large groups of students.

The Multimedia Resource Center will be the central location for technology at the First Program. Both teachers and students will use state-of-the-art technology, as well as other resource materials. New Lab staff will work with faculty on individual class curricula. All First Program students will receive computer instruction in this newly designed multimedia lab. Individual class curricula will be enhanced through the use of computers, while at the same time computers will be integrated into our students' daily lives.

The following is a list of equipment which will be housed in the new Multimedia Resource Center:

10 Macintosh IIsi
10 Keyboard
10 13 inch RGB Monitor
3 HP Deskwriter C with cable
1 Macintosh LC with emulator card (currently have)
1 large monitor for demonstrations
1-2 Apple ImageWriter printers with color capabilities (currently have)
1 HP Desk Scanner IIc
1 Laserdisc Player Pioneer LDV 4200 with bar code reader and remote
1 VCR
1 VHS Movie camera and tripod
Mouse pads

Possibilities:

Modems (for Prodigy and possible NASA communications and other projects).

As a means for acclimating students to technology-rich environments and developing basic technology skills, 12 additional Macintosh computers will be purchased to allow each classroom to have a compatible computer set-up. With these classroom computers students will be able to explore individually, reinforce skills acquired, and continue work begun in the Multimedia Resource Center.

Attached is a list of our current software inventory with commentary .

Software:

Software should be a priority in order for our program to be successful. Much good software has already been designed and published. There is a continuous need to preview and order worthwhile pieces of software which can be integrated in classroom curricula. We hope to meet with groups of teachers so that they can become familiar with the software and to include them in the assessment process. It is hoped that the First Program will receive a monetary commitment towards this end.

Additional Resource Materials

In order for this room to function as a First Program Lab the room should contain the following resources:

1 CD-ROM Children's Encyclopedia.
1 set of *World Book Encyclopedia.*
1 *Computer Awareness Series.*
6 *Webster's Dictionary.*
6 *Hammond Atlas.*
4 *World Almanac.*
4 *USA Almanac.*
6 *Webster Dictionary for Children.*
10 Dry Erase lap boards (thoughts can be outlined prior to computer use).

Various computer magazines
Byte
MacWorld
MacUser
A+ Insider.

Various educational magazines

Instructor.

Physical Layout

We will need computer work stations physically appropriate for young children, the necessary electrical outlets, additional work areas for research activities, and storage space for hardware and software. We have shown our equipment list to Moira McClintock. She is going to suggest some layout possibilities.

Teacher Training and Coverage

In the beginning of the school year, it would be a worthwhile experience for teachers to learn computer skills concurrently with their students. This will enhance teachers' knowledge of computer capabilities. Individual programs can be organized once teachers and their students are comfortable with the basic skills.

In addition to New Lab staff and classroom teachers, we hope that the reading, math, and other specialists will make themselves available to staff this room. It is important that they become familiar with First Program hardware and software. With this plan, everyone will be working together.

The following is a general outline of the plans for the coming year:

1) The New Lab is sponsoring faculty workshops which will take place at the end of August. Twenty-one First Program teachers have shown an interest in these hands-on workshops.
2) We will help teachers explore the many ways they can use computers to improve their individual work styles while giving their students a richer academic experience. For example, as dramatic productions are an integral part of the First Program activities, students can easily create scripts, playbills, and invitations using the computer.
3) It is our plan that all third grade students work with an age-appropriate word processor and various tool programs during their archaeological dig. Neil Goldberg, First Program Archaeologist, believes that this a great opportunity to integrate the computer with this program, and is prepared to give us his full support. We plan to teach touch typing skills prior to this

project.

4) Don Nix, of IBM, has given a written commitment to Karen Bass, First Program Technology Coordinator, that at least 2 IBM computer workstations will be placed in classrooms at the First Program. During the course of the 1992-1993 school year he will be at Dalton two mornings a week to work with the First Program. Don will conduct workshops as well as work with individual teachers and their students. He is prepared to teach word-processing, tool applications, as well as multimedia activities.

   One of the computer workstations will be placed in third grade classrooms on a rotating basis. We will work with the classroom teachers to find relevant video discs to compliment their individual programs, or Don has stated that we could develop new materials. The other computer workstation will be rotated throughout the first grade classrooms. Don has met with Judy Visoky, first grade teacher, and members of the New Lab staff to demonstrate programs that will be made available to her students. He also described special projects and presentations that he will bring to the Dalton community. It is his idea to also employ multimedia for language and "expressive learning" activities.

5) The *Dynotype* prototype will be completed and deployed in Gail Healy's kindergarten class and Mary Mellow's kindergarten/first grade class. Subsequent to the deployment of the program Gail and Mary will provide a written assessment of its pedagogical value and suggest modifications to enhance its educational impact. Upon completion of proposed modifications the program will be used by all kindergarten classes.

6) An ongoing project will be to familiarize ourselves with grade level programs so that we can work with teachers to enhance their programs using computer software and modern technology. For example, a second grade teacher used a program about the rainforests. We will work closely with her to enhance the work that she has begun.

7) We would like to look into the opportunity of setting up a community service program with high school students that

enjoy working with computers. These students can work with classroom teachers to help them with their computer programs. These students could also help Dalton parents set-up their home systems.

8) The New Lab will hold on a regular basis informal meetings with First Program teachers to preview and evaluate a variety of software. The new director of the First Program, Dr. Hill, actively supports the goals inherent in this plan.

9) In order to more fully acquaint students with the step-by-step approach towards problem solving demanded by computers, the students will be introduced the fundamentals of programming using HyperCard.

Software Inventory: First Program

Borderbund:

Spelunx -- Exploratory program.

Where In The World Is Carmen Sandiego? -- Geography.

Where In The USA Is Carmen Sandiego? -- Geography.

Where In Time Is Carmen Sandiego? -- History.

Carmen Sandiego programs create an interest in geography and history, and if used with research materials they can provide a worthwhile learning experience.

Kid Pix -- Tool program that can be integrated into almost all class activities.

The Print Shop -- Tool program that will enhance classroom writing projects.

The Playroom -- Exploratory program, can be used with kindergarten students to introduce the computer.

The Learning Company:

The Writing Center -- Word processing program for elementary grades. It is sufficient for our use, but we will continue to preview others.

Math Rabbit -- Drill and practice for beginning math students.

Reader Rabbit -- Drill and practice for beginning readers.

Computerware:

Crossword Magic -- Good tool program that can be used by both students and teachers.

Great Wave Software:

Reading Maze -- Drill and practice. Great graphics. Students enjoy program.

Number Maze -- Drill and practice. Great graphics. Students enjoy program.

Number Maze: Decimals and Fractions -- Drill and practice. This program i s not appropriate for the First Program needs.

Maxis:

SimAnt -- Simulation that encourages small group decision making.

Microsoft:

Microsoft Works -- Word processing program.

Tom Synder Productions:

Decisions, Decisions The Environment -- can be used in a classroom setting with teacher direction. This program requires a large time commitment on the part of the teacher in order to fully understand and utilize its possibilities.

The Ellen Nelson Learning Library:

Math 1 Mechanics of Word Problems -- Drill and practice. Very slow and boring.

The Rainforest

FIRST PROGRAM: CURRENT HARDWARE -- JULY '92

Computers:

10 Macintosh SE 580
2 Macintosh Classics (one in Health Office)
1 Macintosh LC

Printers:

3 H-P Deskwriter (b/w)
1 H-P Deskwriter (color)

Additional Hardware:

1 large monitor
1 Macintosh IIci and Rodime R45 plus CD-ROM currently used by First Program New Lab staff.

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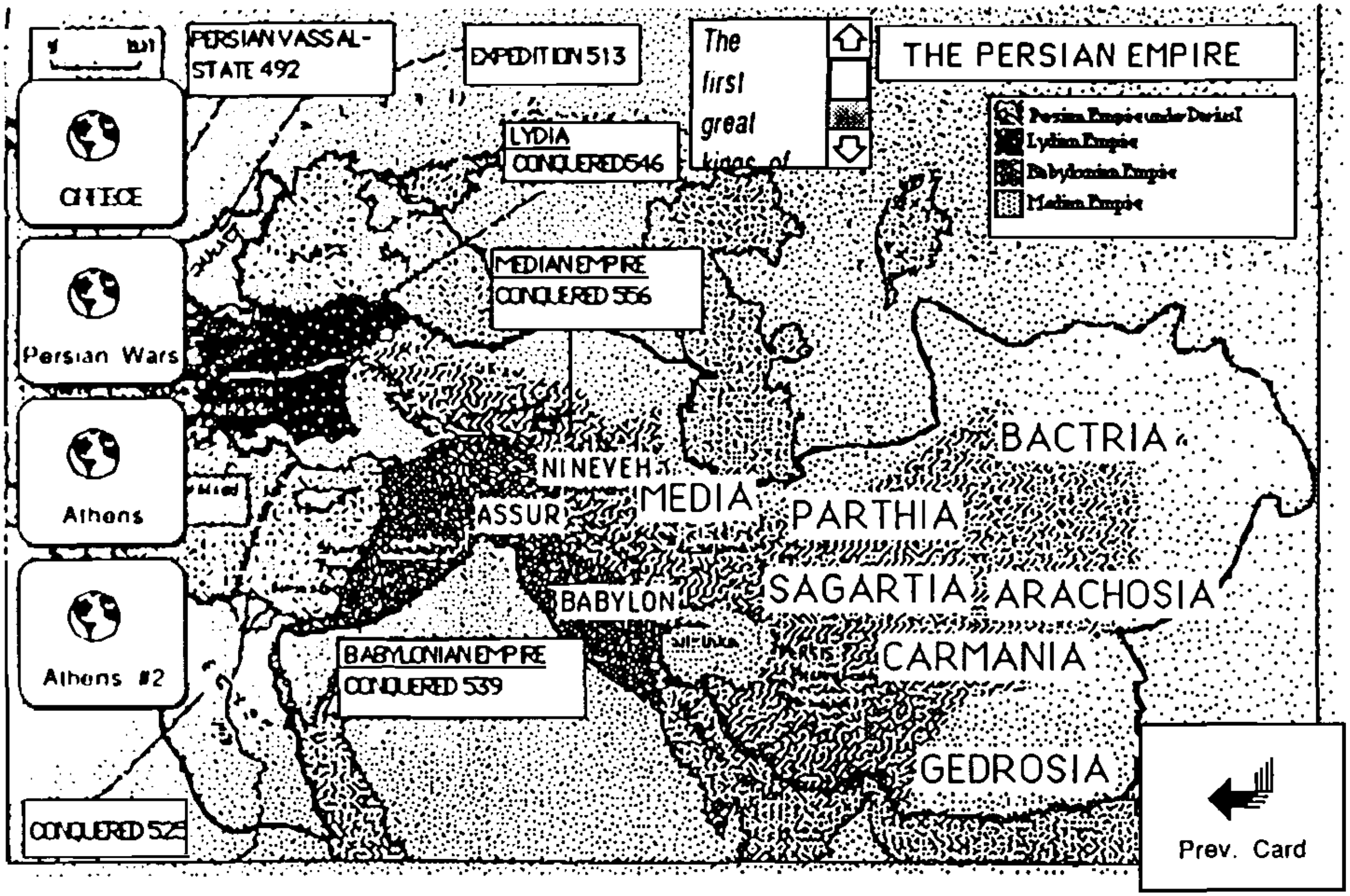

PERSIAN VASSAL-STATE 492
EXPEDITION 513
The first great
THE PERSIAN EMPIRE
Lydian Empire
Babylonian Empire
Median Empire
LYDIA
CONQUERED 546
MEDIAN EMPIRE
CONQUERED 556
Persian Wars
Athens
Athens #2
NINEVEH
MEDIA
ASSUR
PARTHIA
BACTRIA
BABYLON
SAGARTIA
ARACHOSIA
CARMANIA
BABYLONIAN EMPIRE
CONQUERED 539
GEDROSIA
CONQUERED 525
Prev. Card

The Middle School

Reorganizing Time and Space in the Middle School:
Peter Sommer
Director, The Middle School

This year, the upper Middle School (grades six, seven, and eight) has inaugurated a new schedule structure. The main elements of this structure include the creation of two small "communities of learning" on each grade level, cooperation between small groups of interdisciplinary faculty within those communities, and a departmental Lab system. Each child in the sixth-through-eighth grade will be working with three core teachers, one in English, one in math, and one in the social studies. These three core teachers will share a common set of students, a common schedule, and common planning time. As a result, they will have ample opportunity to meet and discuss the individual needs of children and the structure of curriculum at their grade level. We hope that this restructuring will lead to a more thoroughly integrated and consistent curricular philosophy. I expect and hope that it will also have major ramifications in the areas of reporting, conferences, and parent involvement.

Why Move to a Core Structure at this Time?

A core group of teachers and their students can work together to achieve academic and personal goals for students. Teachers share responsibility for the same students and can solve problems together. Common planning by teachers of different subjects enables students to sense consistent expectations for them and to strive to meet clearly understood standards of achievement. Such teaming creates a learning environment that encourages students to grapple with ideas and master skills that may span several disciplines.

As teachers take full advantage of this new structure, I believe the Middle School will more productively respond to diverse learner needs. Core teachers can engage in more frequent and more in-depth professional discussions than has heretofore been possible. Our core time structure will not only allow for twice weekly discussions with colleagues concerning students, instruction and curriculum, but also for frequent discussions with counselors, preceptors, administrators, and parents. This increased communication can lead to more teacher/parent communication about decisions that most directly affect a child's education. A core teachers' meeting, during which student needs are discussed by the three teachers who know the student well, is a convenient vehicle for gaining a broad overview of how well a student is doing in several different classrooms. This practice facilitates the House Advisor's, and therefore the parent's, efforts to keep up to date with regard to our children.

Such a restructuring also allows us to exploit the Dalton Lab to an even fuller extent than we have in the past. Decisions about apportioning time for instruction, for individual and small-group work, and for other activities will be better able to accommodate the wide variety of learning styles and behaviors characteristic of the sixth through eighth grade developmental period. The core teachers will be better prepared to help students learn and develop strategies for managing their time. After inflexible times such as arrival and departure, lunch, and classes taught by non-core teachers have been determined, each team of core teachers takes responsibility for working out a core schedule for the time that remains. Because these teachers are closest to the instructional program, they are in the best position for establishing instructional priorities and judging the most appropriate way to apportion time. They can recognize opportunities for multidisciplinary instruction, ways to coordinate homework and testing, and strategies for uniform support of curricular initiatives.

Utilizing Technology

The new structure allows us to work with emerging technologies in many ways never before available. Each group of cooperating House Advisors has been provided with one networked classroom. Each such classroom contains four computers, all of which are hooked into the Dalton network. Thus, there are two networked classrooms in each grade level six through eight. This provides each cooperative group the ability to work on existing curricular projects (such as *Archaeotype* or *Playbill*) and the freedom to develop its own ideas for the use of the machines. In addition, this arrangement gives students in each section of the grade access to the network during their regular school day, without leaving their assigned rooms. Therefore, students can themselves develop projects and do research through the network with minimal discomfort. Under the new departmental Lab system, we will utilize the two networked rooms on each grade level as Lab rooms during the outer cycle. When upper Middle School children are free, these rooms are also free and open for their use. Thanks to this restructuring, children can now work on the network during their regular Lab times, while an English, Math, or Social Studies teacher supervises their efforts. Simply put, our goal is to exploit the Dalton plan so as to meet the unique learning needs of students at a crucial stage in their development.

* * *

Computers and Writing

A Plea for Support:
Monica Edinger
Teacher, Fourth-Grade English
December 9, 1991

Here are some of my views regarding writing and computers I hope that it will help you understand my orientation before our meeting on Wednesday.

This is my fifth year as a fourth grade House Advisor. Before that, as you may recall, I was a Middle School computer specialist, sixth grade English and Social Studies teacher, and sixth and seventh grade House Advisor. I got into computers and education years and years ago because I was excited about their potential to revolutionize writing instruction. I have a Masters from Columbia in Education and Computers and have done lots besides writing and computers, but that is still my great interest.

> For the most part, we have tried to promote collaborative work among students by having small groups of students work together at workstations. Ms. Edinger has made a case for a different configuration, having students work singly, each at their own computer. Given limitations of space and finances, this is not an easy configuration to implement. Documents that follow here outline the process by which we have arrived at a compromise which should in time implement the best aspects of both configurations.

Seven years ago I participated in a Writing Institute at Columbia with Lucy Calkins. Lucy, Donald Graves, and Nancy Atwell are well-known names in the process writing movement. This approach to writing has been supported by a great deal of research over the year. It is the way I have taught writing to sixth graders and fourth graders. Basically, the focus is on the writing process rather than the product. In my fourth grade class I run a daily writing workshop. We focus on the actual writing. There are lots of conferences, we hold frequent group response sessions, and the children do frequent revisions. I try to get them to look carefully at what they write and consider multiple drafts of a piece. The atmosphere is relaxed, but everyone knows that writing is the overriding focus during the workshop.

The primary stumbling block for many fourth graders when it comes to writing is physical. Some of them still find the physical act of writing with a pencil quite difficult, others are very self-conscious about their handwriting. These issues can seriously interfere with a child's ability to express him/herself on paper. Since we still value written expression overall others in school I feel strongly about doing all I can to help a child be able to express him/herself to this best of his/her ability. Computers can greatly help a child succeed as a writer, especially those who have had previous limited success due to such constraints as I mentioned previously. Once a child (or adult, for that matter) has become familiar and comfortable with the machine, writing becomes far less of a chore. No longer does a child have to worry about letter formation, he/she can focus primarily on content, saving formatting and skills for the final copyediting stage, as is done in real-life publishing situations.

In the past with one (now two) functioning computers in my room, I have had to given priority to one or two children during the writing workshop. For the rest, the computer is used at the final draft stage, when children are ready to publish. Even then, access has become a greater and greater problem each year. The children want to write on the computers and can't because of the access problem. At the moment my frustration is because not only can't I teach writing using this wonderful tool, but the children can't even use it to create final drafts due to unavailability.

I am always laughed at when I say that I need 19 or 20 computers during class session. Yes, I know we have no facilities like that, but that is because you (or those who decide on hardware purchases) do not place value on writing and computers. I think the other New Lab projects are great. I just don't see why the school can't also consider less sexy projects like a writing lab or writing project. I have proposed to Peter and will now propose to you that since there is no space available for 20 computers, then buy 20 laptops (they don't have to be the most powerful on the market, don't worry about datedness, after all I am using ancient

Apples in my classroom right now) and have a location where a teacher can sign them out for a class session. If control is a problem I would be happy to help. I'll set up a schedule, see that they are powered up, whatever is needed. With laptops the space problem would be eliminated. Also, if these computers were meant primarily for writing the other labs would be freed up for other projects. The laptops could also solve another problem equity. It concerns me that while many of our students have computers, some don't and don't have the resources to get them. They need to be aided in access to computers for writing so they can have the same advantages that writing on a computer provides. I think you would see lots of exciting things happening with the laptops. Making them easily accessible will make teachers who are not as confident about computers or writing process begin exploring their potential. I think lots of exciting possibilities exist. I have a friend who set up a computer school in New Jersey and has great success with laptops. It just seems to me like a great way to improve writing instruction and access at the same time. Think of the computer as a writing tool (of course it has far more potential than just as that, but it is very very powerful as a writing tool) like a pencil. Ideally, I want computers to be as accessible in my writing workshop as pencils are. One or two computers in 3 classroom have fairly limited use, far better to have a class set available for occasional use. It doesn't do me any good that other classes have one or two computers during my writing period. Those teachers are teaching and don't want one of my students in there using a computer. Please come and see my workshop in action, then you might have a better sense of why I want one computer per child.

I have quite a lot of literature on writing process, whole language, and writing and computers. I would be happy to lend some to you or tell you more. Please tell what I can do to make this a reality. My frustration is watching more and more money being used to develop computer use in certain curricular areas with this area still neglected, despite my constant advocacy for writing. I reiterate my admiration for the New Lab ideals and projects. I think *Archaeotype* and *Playbill* are wonderful projects and I am excited about the possibilities they present and hope to have an opportunity to be a part of such new developments.

* * *

Trial for Writing Tablets in the Fourth Grade

April 27, 1992

10 Tandy laptop word processors (WP) 4 batteries per WP 2 rechargers

Four batteries will be used for each WP, and then 8 will be being recharged. There will be a schedule for who changes their batteries when, changing batteries means taking the uncharged batteries out of the computer, putting the charged batteries in, and finally putting the uncharged batteries to be charged.

> This brief working document outlines a trial Ms. Edinger conducted last Spring, which is leading to a fuller test of her ideas this coming academic year.

Students will be two to a laptop, each laptop will be labeled with the students name using a sticky label.

Students will use the laptops to record their writing, and then download it to one of two networked Macs, which will be sitting on tables at the side of the classroom.

The rest of the academic year will be used for testing this setup, and then next year if this is successful, 10 more laptops will need to be acquired so there can be one per child.

Things to do:

- Sort out how to transfer files from Tandys to Macs
- Find out whether we have logo writer -- is it a networked version?
- Find out whether we have Bank Street writer 3: does it have publishing capabilities?

Things to get:

- 4 batteries: we need 48 in total; currently we have 4.
- 2 networked Macs, (for final preparation and printing).
- 1 cable to transfer data: we currently have 1, but will need two.

Things for future

- Evaluation methods.
- Ordering additional Tandys.

* * *

Tandys in My Classroom:
Monica Edinger
Teacher, Fourth-Grade English

June 9, 1992

Here are some observations, thoughts, and recommendations regarding the Tandys and my experience with them.

Tandys and Technology in My Learning Environment

It has been very exciting to receive the Tandys. Since they came late in the year, a few at a time, we began using them as transcription tools. The children were required to publish a book before the end of the year using anything they had written in the workshop. Some had already published and did a second book, others competed final copy for their first books. When the Tandys came the class decided, with my help, how to allocate them. We gave priority to students who had not already begun final copy on the Apples or Macs. Since the transfer had not yet been worked out (that is transferring files from the Tandys to a Mac) we were fortunate that Robert Mason lent us his personal printer so that we could print from the Tandys. Children sharing Tandys tended to become distracted when waiting for their turn. One child took tremendous care to type with one finger her lengthy memoir about her work in opera; a child who feels self-conscious about her spelling and handwriting. For her, the computer was fabulous. I loved looking around the room and seeing children at their desks, sitting on the rug with a Tandy on their stomach. I have always encouraged children to find their best way to write, how wonderful to have another incredibly powerful way to get one's thoughts out to others!

Late in the year we also used the Tandys to write a book on the Maya. Ten chapters were written on the Tandys. In this case all composing and drafting was done on the computer. By this time the transferring from Tandy to Mac had been worked out, so the children were able to transfer their text to the Mac where it was collectively formatted. It was remarkable what high quality of work the children were able to produce in a very brief period of time. It was unfortunate that there was not a computer for every child so that this meant some children wrote by hand, others on what computers they could find. In fact, in two cases Rachel and I retyped children's work since it had been done on non-transferable software, and we wanted to include it (with the same formatting) in the book.

What has become very clear to me is that I must have one Tandy per child in order to use them as true writing tools. With ten, some children used them for writing, many are used them as transcription tools. The complicated logistics of limited resources caused me to have to spend more time managing their fair use when I would have preferred to he working with children on their text. If each child had one I think that their potential would be enormous. I have recently read an excellent book put out by the National Council of Teachers of English entitled *Evolving Perspectives on Computer and Composition Studies*. The articles are about the enormous potential computers have on transforming literacy. (The authors also raise serious questions about access, equity, and gender, questions that also concerned me at Dalton.) I have been arguing that I needed a computer per child because they were writing tools like pencils. I now think of the Tandys as far more than electronic pencils or super typewriters for these children. They have the potential to transform my students as writers and as learners. Rather than seeing the Tandys as only electronic pencils I now see them as space age blocks, capable of doing anything that we can come up with or the children dream of. Blocks, in a primary classroom, have limitless possibilities. Last fall I visited a first grade at the First Program where the children had built a Mayan temple out of blocks. That same freedom is available with individual Tandys for writing. If the children have them available as needed for writing I anticipate great things. For, example, we will write our Maya book on the Tandys. The book came up in the course of our work on the Maya. Who knows what might happen with adequate Tandys in this learning environment? Rachel Bellamy and I have been discussing creating a database of Palenque images for next year's class. From there we began thinking about the potential of using these images and the Tandys in some kind of hypertext environment -- now that is a truly new and different way of writing!

Equity

I am very bothered by the issue of equity in the context of computers and writing. It is certainly an issue when considering Dalton versus a public school in Washington Heights. Yet is a serious issue within Dalton as well. It is directly tied to access which I see as providing sufficient tools to use the power of new technology. Equity has to do with who has a computer at home, who is in Ms. Edinger's versus Ms. Colcough's class. The issue that bothers me the most is the distinction between children who have computers at home and those who don't. When the class and I decided who could use the Tandys I encouraged them to give preference to those who did not have computers at home.

When a classroom has limited computer resources and teachers have a myriad of other things to do "survival of the fittest" seems to be the way the computers are used. We can try to raise the consciousness of teachers, but the reality is that they are dealing with many different things and those students who are most persistent will probably be the ones who will gain access to the computers. Those who are timid, who don't have computers at home, who are least comfortable with computers, who need the most access may not get it in our Dalton classrooms. I am being realistic. We can talk all we want about grouping so that girls gain more access, provide more role models, etc. Despite all the efforts on that score at Dalton, I see serious problems of equity. Our scholarship students often don't have computers at home. What is the school doing consciously to provide them with the tools their more affluent peers have? What will happen to my students after a year of opportunity to write on a computer? Will those with a computer at home thrive the following year in a non-computer rich classroom? What about the students who spend the year with me growing as writers on computers who do not have computers at home? What happens to them the next year when they are in a class with a teacher who does not have computers galore, doesn't use them herself, and lacks any sense of the disparity between those of her students who have computers and those who don't? Of course, I want all the computers I can get and feel I can do a great job teaching with them. However, the New Lab and Dalton need to consider what happens to these children as they move on. Equity is a huge problem, one we really need to think hard about.

> Based on the success Monica Edinger had in the Spring of 1992, Peter Sommer, the Middle School Director, has decided along with the Tishman Directors that the project should be expanded to at least half of the Fourth and Fifth Grade classrooms. To that end in the Fall of 1992 forty Tandy WP II's will be made available to the Middle School as well as one dedicated Mac printing station.

Recommendations

For my students to truly explore the potential of writing with computers they must each have their own machine during the writing workshop. Most likely, I will have a similar class size and schedule next year. Thus, I plan on having separate reading and writing workshops for my class. That means that the computers will be used in the writing time, usually one period a day. With ten computers, ten children will be able to use them during one period, the others would continue writing with traditional tools. I would most likely assign the Tandys to children I felt could most benefit by them, at least to start. This sets up all sorts of negative feelings in the class. Children not using Tandys will, naturally, be distracted by those who are using them. Rachel and I have observed that in my class this year. I simply can't see the computer's potential as something to transform and revolutionize literacy occur in such an environment. I would far prefer that all the children in my class have the chance to use them as much as they want. Thus, I would strongly recommend that you procure eleven more Tandys so that I will have twenty-one, definitely enough for my one per child model.

Certainly with twenty-one other teachers and classes should also be using the Tandys. Peter and I discussed the possibility of my working as a writing resource in other classrooms. We both saw my using the Tandys as a way of encouraging other teachers to try the writing workshop approach. Even if I don't have this role, I would certainly expect that the Tandys would be used be other classes when not used by mine. Most likely, they will excite the imagination of these other teachers and students as well! Rachel and I would welcome an opportunity to expand what is happening in my classroom to others as well.

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Computers and Writing in the Classroom:
D. Kramarsky
Teacher, Eighth-Grade English
M. Pollak
Teacher, Sixth-Grade English

(Click your heels three times and say: "This is a DRAFT.")

This proposal outlines a plan which will enable us as Sixth and Eighth Grade English teachers to transform what we do in the classroom on a day-to-day basis. Coupling recent paradigms in English education with new and emerging technologies, it will empower both the teacher and her students to reach out in ways never before possible.

The technological aspects of this program require eight (8) networked microcomputers to be placed in Room 711. Two printers, one laser and one dot matrix, would be optimal. The physical layout of the room would remain unchanged, though new furniture needs would be imminent. Software suggestions for this program will be footnoted throughout.

> This proposal, like Ms. Edinger's aimed at process writing for the Middle School, uses the configuration of small groups working at networked computers in the classroom. Ideally, the two configurations should be joined, we now think. Ms. Edinger stresses the process of composition where each student naturally works independently. Mr. Kramarsky and Ms. Pollak stress the process of revision where it is helpful for students to work in small groups, helping each other to internalize, as writer, the gentle voice of the reader.

The program outlined here impacts on all aspects of the Dalton English curriculum, and introduces some elements which, while necessary for literacy in the next millennium, are not generally conceived as part of a traditional English curriculum. It includes but is not limited to:

- The Use of New Information Resources
- The Writing Process
- Skills Development
- Vocabulary Instruction
- Spelling Instruction
- Grammar Instruction
- Notetaking
- The Lab
- Projects and Presentations
- Evaluation
- The Impact of Technology
- Integrating the Curriculum

Let us take each of these areas singly.

The Use of New Information Resources

New technologies in the classroom and in the workplace will demand new abilities of our students. Along with the dictionary and thesaurus, many common forms of reference are more and more available in electronic forms. The use of these new reference tools will require a complex cluster of new skills. Only with these skills in hand will the students of the information age find the new technologies enabling.

The workstations in our classroom should be equipped with dictionary, thesaurus and encyclopedia software.[2] Ideally, modem access to outside networks as well as an in-house bulletin board system should be supported. We envision a frequently updated and fully electronic research environment in the *classroom*.

With this technology in place, the skills necessary to complete reference tasks on workstations become essential. They will be part of our curriculum. Non-linear modes of information access, retrieval and analysis will become a greater part of the research

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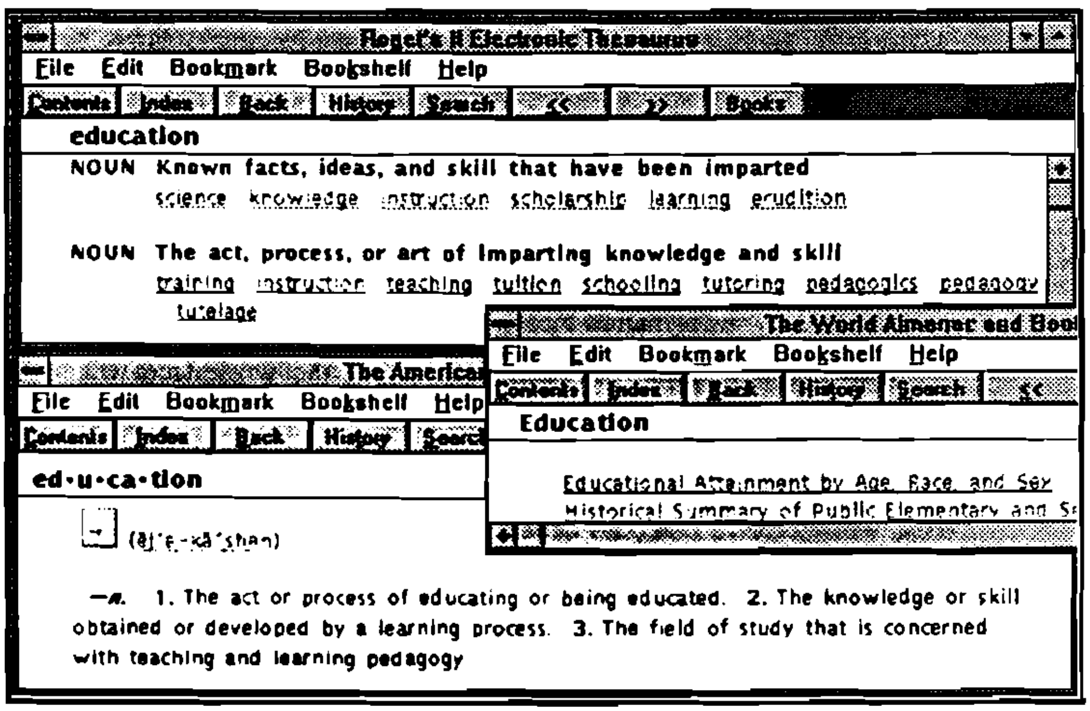
[2] Examples: *American Heritage Dictionary, Macintosh Edition* (Writing Tools Group, Inc.); *Random House Encyclopedia. Electronic Edition* (Microlytics, Inc.); *Franklin Language Master 2.0* -- Merriam-Webster Dictionary and Thesaurus (Franklin Electronic Publishing, Inc.).

paradigm. We will be able to teach directly and by example, within the framework of the current Dalton English curriculum, such skills as:

- The use of an integrated electronic dictionary/thesaurus, including new word search strategies not available or less easily accessible through hard copy reference materials;
- The use of an electronic encyclopedia more friendly to



non-linear (hypertext) research and retrieval methods;

- The use of dial-up services such as New York Times or Dow Jones news retrieval;
- The use of electronic databases concerning academic journals, specific knowledge areas, the arts and current events, all as they pertain to the curriculum areas being studied.

The Writing Process

The existence of a significant number of workstation-quality microprocessors in the classroom does more than facilitate many of the more difficult and time-consuming facets of writing process instruction. It utterly transforms and revitalizes writing process in many ways. Drafts of written work can be completed *in class*. Once this is done, a record of each student's draft is available on the computer. Therefore the computers, along with the appropriate software:

- Make frequent revision of drafts *in class* possible;
- Allow students to edit work in pairs and small groups with ease;
- Allow students to merge and edit one another's work--thus several students could begin work individually on a given essay topic, bring the files together on one machine, compare and revise together, and end with a final draft reflecting their group process;
- Allow the teacher or other students to type *directly into the students' files* computerized comments or 'post-it' style notes which would then become part of the teacher's personal permanent record of each student's progress;
- Add depth and dimension to pre-writing (through the use of an outline processor), bringing to the brainstorming or outlining phase of the writing process all the benefits listed for the writing process as a whole;[3]
- Bring mechanics of writing skills into closer integration with each student's own written production (as described more thoroughly in the next section);
- Empower students to present their finished work on-screen[4] without losing the teacher's record of such a project.
- Provide new strategies for presenting papers: in-class reading of a paper need not be done aloud--the paper can be "brought up" on all screens and students can read it quietly at their own pace.

Skills Development

Traditional skills development programs in the Dalton Middle School have relied extensively on textbooks and frequent tests. New technologies will enable us as teachers to break free of such modalities if we wish, and to use them more effectively when we feel they are necessary.

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[3] Example: *MORE 3.1* (Symantec, Inc.) would enable students to benefit from the process of revision, peer editing, merging and revising files, and electronic commentary -- all at the outline stage of pre-writing.

[4] Through a program such as *MORE 3.1* (Symantec, Inc.) or *SuperCard 1.5* (Aldus, Inc.). A persentation-size screen in the classroom would facilitate this type of project, but would not be necessary for its implementation. See below, *Projects and Presentations*.

All current methods of skills development may be greatly enhanced. For example, it would take relatively little programming to make grammar, spelling,[5] and vocabulary tests (as currently given) available on each computer. The children could prepare for and take these tests *at their own speeds*, with the computers keeping track of their progress and forwarding a record to the teacher. The paragraphs below outline some new ideas made possible by the addition of networked workstations to our classroom.

Vocabulary Instruction

As children do the readings, new words could be kept on computerized lists. Each time a student used the dictionary, the word in question would be added to the list for that child. (The programs mentioned in footnotes to this document already keep such lists automatically.) These lists would then be used for vocabulary tests. In addition to or in place of the current vocabulary book, students would be tested on vocabulary arising directly from the texts studied in class.[6]

Spelling Instruction

Using a spelling checker, each child can record a list of those words he or she has misspelled in his or her written work. *This becomes a personal spelling dictionary for each child.* Instead of testing from a textbook, each child can study and be tested individually. The element of boredom which looms before the more gifted spellers is removed. The degree of difficulty in spelling instruction is, with the teacher's assistance, calibrated to the individual needs of each child.

Grammar Instruction

Many of the ideas suggested for improving spelling instruction (and endorsed by Writing Process theory) can be applied equally well to grammar skills through the use of a grammar

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[5] For this one would need a program enhancement such as *MacInTalk* from Apple to pronounce the words and sentences as input by the teacher.

[6] In the long term, texts in the current curriculum could be scanned into the computer itself, thus allowing for teacher marking of new vocabulary, in-context examples, contextual searches, etc.

and style checker alongside a reference guide for writers.[7] Each child's mistakes in grammar and style can be catalogued, recorded, and addressed on an individual basis. This makes the grammar lesson more real to the student. Grammar can be integrated more thoroughly into the writing curriculum, and taught naturally and syncretically in the context of each student's own written work.

Notetaking

In-class notetaking is transformed utterly. Notes on class discussions and presentations are taken *on the computers*. This gives each child a record of the questions asked and the answers given--a record from which they can later study. The notes can be integrated into papers and tests, as well as standing as a record.

The Lab

The presence of each child's complete corpus of work as a record on the computer network greatly aids productivity in the Lab. The technology helps a teacher to hand back a paper, work on it with a student, address specific and individual skills problems, and chart and update the student's progress. In addition, since the teacher types her comments directly onto the computer record of the child's work, the teacher does not have to "hand work back" in the usual manner. Each student can work on his or her own work during *his or her lab time*, guided by the teacher's electronic notes.

On a purely operational note, these Labs can take place anywhere in the building where there are networked computers, since all the work will be available on any workstation connected to the network. Teachers and students need not meet in any specific room.

Projects and Presentations

As many businesses have learned, presentation design is made much easier by certain software packages. The addition of one of

[7] Examples: *Correct Grammar 2.0* (Writing Tools, Inc.); *RightWriter, Mac* (QueSoftware); *The Elements of Style, Electronic Edition* (Microlyfics, Inc.); *American English Writing Guide* (Nova Development).

these packages to the network helps us in the classroom in two discreet ways:

- It allows for greater diversity in the presentation of children's finished work. With relatively little programming skill, students can create "slide shows" and animated projects to show their work. A bit more skill is required to take advantage of hypertext and other non-linear environments, but this is still well within the capacities of our Middle School students, as ongoing experiments at Dalton have already shown;
- It enables all such "project work" to be saved on the computer. It then exists not only as a record for the teacher, but also as a continuing study aid for students in its "parent" class and in other classes.

Evaluation

At each phase in the delineation of this proposal, it has been noted that one benefit of performing all operations on a network is that a permanent record exists for the teacher. Clearly this will greatly ease the report writing process! All methods of evaluation, testing, and reporting, however, are facilitated by this new technology. Several new ideas can be implemented, especially as involves student self-evaluation. A few examples follow:

- Students can write in electronic "journals" on a weekly basis, evaluating their own progress. These journals are available to the teacher whenever she need to evaluate progress, without collecting anything. Thus they are never unavailable to the student.
- At report time, the student is able to see a record of his or her own work in all areas--the same record the teacher sees. Each student can write a report of his or her own.
- The teacher need no longer rely on his own notes about a paper or presentation submitted several weeks or months earlier. The actual writing exists for him to look over, with the student if need be. Semester to semester progress is likewise preserved.

The Impact of Technology

With the increase in access to new technologies, the correct and socially acceptable use of those technologies becomes a curricular issue. Respect for other children's writing, issues of electronic privacy and piracy, BBS etiquette, and other similar issues must be addressed directly.

The social impact of these technologies is as important to our curriculum as the academic skills necessary to access them.

Integrating the Curriculum

Dalton already has a powerful microprocessor network. We envision these new microprocessors as a part of that network, not a separate entity. Therefore, it becomes possible to integrate the new English program with existing programs in other disciplines. In addition, different English sections can themselves be brought together through the recording abilities of the network. If, for example, two Sixth Grade sections wished to work together on their Greek Festival play, the network would make this possible. Integration across grade levels is also feasible. The Sixth and Eighth Grades could work together on projects. Through the existing high school computers, Ninth Grade students studying the Odyssey could help Sixth Grade students studying the Odyssey. Integration of the curriculum can be achieved across sections, grade levels, disciplines and divisions.

> In conjunction with Peter Sommer's restructuring of the Sixth, Seventh, and Eighth Grade schedule (See pages 147 to 149 for a full description of the plan), Kramarsky and Pollak will have available one of the three technology enhanced classrooms, each of which will have four Macs with the full range of software available through the network, as well as its full printing capacity. Any student will of course be able to use any of the networked Macs, whether in the library, in one of the labs or in a classroom. It is the plan of the Middle School Director that the project in the course of the year will expand to at least half of the upper middle grade students.

This proposal reflects a transformation and redesign of practically every aspect of the English curriculum. Using new technologies and new ideas in English education, we hope to bring to Dalton's Middle School students the skills they will need to prosper in the information age.

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Computers and Geometry

A Proposal For Extending the Seventh-Grade Mathematics Curriculum:

Robert Mason
Teacher, Seventh-Grade Math

> Geometry is grasping space. . . that space in which the child lives, breathes and moves. The space that the child must learn to know, explore, conquer, in order to live, breathe and move better in it. (Freuduenthatl 1973, p. 403)

What one already knows plays a major role in determining what one can learn. We can agree that a student's prior knowledge may be the most important factor in what he or she is able to learn. This view of learning sees knowledge as more than just an accumulation of bits of information. Rather, knowledge is viewed as a structure into which units of information are integrated. These units of information and the ways in which they are linked together are referred to as conceptions. Prior knowledge is a collection of related and interrelated conceptions.

Learning mathematics is an ongoing process of conceptual change. New bits of information interact with existing knowledge in a gradual, cumulative way. Changes in conceptual views often require that learners restructure their existing knowledge. In fact, conceptual change may sometimes require that a learner reject existing knowledge in favor of new knowledge.

The Need

Seventh grade at Dalton is the year where students master elementary arithmetic and begin to see the relationships that exist between numbers and symbols. During the fall term students engage in activities the emphasize computation. During the spring term the students continue their work with computation but they also move into topics that use the generic form of the algorithm. For example, they will solve simple computation problems with the laws of exponents. The content that is covered in the seventh grade is necessary, but to further improve the quality of mathematics offered to our students we should use the recommendations that are outlined in the NCTM standards to create a mathematically enriched program.

The seventh grade mathematics curriculum lacks a geometry component. The NCTM standards suggest that "the study of geometry helps students represent and make sense of the world. Geometric models provide a perspective from which students can analyze and solve problems, and geometric interpretations can help make an abstract representation more easily understood. Many ideas about numbers and measurement arise from attempts to quantify real-world objects that can be viewed geometrically. For example, the use of area models provides an interpretation for much of the arithmetic of decimals, fractions, ratios, proportions, and percents."[8]

In addition to offering practice with basic skills the geometry component encourages students to discover relationships and develop their spatial sense by constructing, drawing, measuring, visualizing, comparing, transforming, and classifying geometric figures. Moreover, through an early informal experience with discussing geometric ideas, conjecturing, and testing hypotheses prepares them for a more formal presentation of the subject matter. In the process, definitions become meaningful, relationships among figures are understood, and students are prepared to use these ideas to develop informal arguments. The informal exploration of geometry can be exciting and mathematically productive for middle school students. At this level, geometry should focus on investigating and using geometric ideas and relationships rather than on memorizing definitions and formulas."

The Program

Discovering Geometry[9] offers a storehouse of material that allows teachers to structure a geometry course to match the needs, interests of our students. It's currently in use in a variety of courses, including regular, honors, and informal geometry -- as well

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8 Much of what is covered in the seventh grade practice with basic arithmetic computations. Therefore, adding the geometry component to the existing curriculum will reinforce these skills in a new context.

9 The text by Michael Serra entitled, *Discovering Geometry: An Inductive Approach*, Key Curriculum Press, 1989.

as in integrated math programs. *Discovering Geometry* is based on the *van Hiele* model[10] for geometry education where students first master concepts and relationships they have developed through their visual thinking and inductive reasoning skills. They conjecture and test their ideas. They learn to follow algebraic proofs, building their reasoning and logic skills. The text is flexible enough to allow different sequences to help us plan a course that meets the needs and interests of our students.

The Geometer's Sketchpad[11] breaks away from mechanical limitations. The mechanical drawbacks of the standard tools for studying geometry -- paper and pencil, compass and straightedge often limit students' drawings and obscure vital principles. With *The Geometer's Sketchpad*, any aspect of a figure which is defined geometrically for instance, the midpoint of a segment can be automatically constructed by *Sketchpad*. Precise drawing is fast and accurate, revealing essential relationships with ease and clarity. Once you've constructed a figure, you can manipulate any of its original components. As you transform parts of your figure with the mouse, all related parts and measured quantities update continuously. Extensive text capabilities lets students label, and annotate their figures.[12] Whereas a paper and pencil drawing demonstrates only one case of a geometric relationship, *The Geometer's Sketchpad* lets the students examine an entire set of similar cases in a matter of seconds.

By recording their figure in a script, *Sketchpad* models their construction as an abstract system of geometric relationships, independent of any particular drawing or diagram. They then can play the script back to investigate the construction in related circumstances and in special cases.

The Geometer's Sketchpad models geometry in two linked

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10 The *van Hiele* model for geometry education stresses that students must master concrete concepts before moving to the abstract.

11 A software program for the Macintosh computer.

12 The model of instruction that Mrs. Allen and I have used this year includes components called the TOOLBOX and the COLLOQUIUM. This feature of the computer program is ideal for our purposes.

views. While sketches depict concrete geometry and emphasize spatial reasoning, scripts describe constructions verbally and abstractly. In the sketch window, the students draw with electronic versions of Euclid's tools -- a point tool, a compass, and a straightedge. *Sketchpad*'s menus offer more sophisticated constructions and planar transformations. As students work, they can color, label and annotate their drawing, and measure quantities ranging from simple distances to complex expressions of their own devising. The script window contains generalized descriptions of constructions. The students can record scripts step-by-step themselves, or let the program generate a script to describe a construction they've already sketched. Scripts become part of their basic geometric toolbox, playable from a menu. Use them again and again to generate figures, or portions of figures, while sketching. They can even use individual scripts to build larger and better ones, deriving more and more complicated constructions.

Strategies For Making Mathematics Meaningful

Educational psychologists have identified two types of thinking, productive and reproductive. Productive thinking involved producing new organizations of knowledge, or creating new solutions to problems. Reproductive thinking involved simply applying past solutions, or reproducing old habits or behavior. This distinction has also been referred to as "insight" versus "trial and error" (Kohler, 1925, 1929),[13] "meaningful apprehension of relations" versus " senseless drill and arbitrary associations" (Katona, 1940),[14] and "structural understandings" versus "rote memory" (Wertheimer, 1959).[15]

There are at least four goals of meaningful learning: (1) to help students understand structural relationships (how units of information fit together into a whole); (2) to help students integrate incoming information with their existing knowledge base; (3) to improve students' abilities to apply what they're learned to novel or

13 Kohler, W. *Gesalt Psychology*. New York: Liveright, 1929.

14 Katona, G. "Organizing and memorizing: A reply to Dr. Melton." *American Journal of Psychology*, 55, 1942.

15 Wertheimer, M. *Productive Thinking*. New York: Harper & Row, 1959.

complex situations (transfer); and (4) to improve their ability to retain information over time. The following section describes several strategies Mrs. Allen and I are using this year to teach the integrated geometry course to two groups of seventh graders, and have found useful for helping students make mathematics meaningful.

Inquiry Teaching

Mathematics educators are promoting the use of inquiry, or discovery learning as an approach to teaching mathematics. They feel that the inquiry approach is more compatible with the roots of the thinking process, whereby thinking requires one to examined evidence, constructed explanations based on the evidence, sought alternative explanations and valued the tentative nature of explanations. The emphasis in inquiry teaching is on students engaging in extensive discussions and actively constructing defensible explanations for observable phenomena. Mrs. Kam Allen and I use the investigation /colloquia method of instruction to guide our teaching and activity development.[16] We find that the inquiry mode of instruction does changes the flow of content from teach to the student and from the standard "tell, text, test" process to one where questions and expressions of students' beliefs dominated. And, we've observed several significant behavior changes in our students. Given the opportunity to think "out loud" tends to encourage students to refine their thoughts, and fuel their minds with the "stuff" needed to write about mathematics from a quasi-philosophical perspective.

Below is a sample of one of our student essays that was produced last year as a result of the approach.

Jenny F.

Is Mathematics Constructed or Discovered?

That was the question we set out to answer. However, one thing led to another, and many topics were presented

16 This investigation, colloquia method (I-CM) of instruction is a method used to teach science. For more information concerning the method refer to the science department.

throughout our discussion. There was a general agreement that mathematics owed much to both discovery and construction. Value has always existed, two has always had "two-ness," therefore man could not have constructed that aspect of mathematics. Sounds like "one," "two," and "add," or name for values and operations, are not concepts that have always existed, and could not have been there for man to discover. Value brought us to greater and less, which we analyzed through "the buffalo example." We used one-to-one correspondence, or matching, to determine greater or less than in groups of buffalo. For example, if Set A has (b1 b2) buffalo and Set B has (B1 B2 B3) buffalo, assuming man has not yet named values (or has given them titles different than our current ones), how can the man standing next to Set B prove to the woman standing next to Set A that he has more buffalo? He would use one-to-one correspondence, or matching. We saw that Set A < Set B. We wondered what we could do to make Set A = Set B, or A + k = B.

"+" made us think about "next after" (3 is next after 2, etc.). A mathematical way to this is X + 1. X + 1 is closely related to the concept of infinity. We talked about infinity not being a particular place. We said that you can "chase" infinity using X + 1. The next question proposed was: Does (1) A + k = B, then will k <> 0 explain all cases where A < B?

To answer this question we used X + 1. We used X + 1 because it is one of the best ways to represent infinity on paper. If the highest number you can think of is X and you "+ 1," you have just pushed infinity a little further.

We applied X + A to our statement (2) (A + 1) + k = (B + 1) then k still is not equal to 0. A + 1 or B + 1 is very similar to X + 1. We looked at how statement (1) is related to statement (2). This relationship showed us that no matter how large the numbers are, if you continue adding 1, the greater set will stay greater. You will always have to add to the lesser set some k to make the two equal. The argument I just finished explaining to you proves that our A + k argument would work for all cases such that A was < B.

Clearly, Jenny has an very sophisticated sense of the mathematical idea of infinity and feels comfortable with thinking with "concepts." Had she not had the opportunity to think "out loud" during the colloquium, Jenny would not have known that she had this understanding. The point is, that Kam and I are trying desperately to develop a mathematical voice in each student by encouraging them to identify what they know, to understand how they use their knowledge, and to anticipate the next step in their mathematical development.

We find that we differentiate between activities that involve pure inquiry from those that involved guided inquiry. Guided inquiry procedures involve giving students more hints and direction to ensure that the rule or concept is accurately learned. In pure discovery mode, we were no assured that the students ever really learned the rule or concept in question. Our observations are consistent with what Mayer found from the research he did on the topic. He found that guided inquiry was more effective than those involving either pure inquiry or pure expository instruction. In analyzing the studies, Mayer (1983)[17] interpreted the results in light of an information processing approach to learning and suggested three factors which help increase the effectiveness of inquiry teaching.

1) The student must possess appropriate prior knowledge (prerequisite concepts which are relevant to the new information or concepts);
2) The teacher must make sure that the leaner actually "discovers" the rule or concept to be learned; and
3) The learner must actively integrate the new information with existing information.

Factor one is clear cut and does not need further explanation, but I would like to discuss how Kam and I have addressed factors two and three. I will draw on the work done in Gestalt psychology

17 Mayer, R. E. *Thinking, Problem Solving and Cognition*. San Francisco: Freeman and Company, 1983.

again to illustrate the strategy we use. There is a component of several psychological test the requires the examinee to choose the correct complete drawing after studying an incomplete drawing that visually displays minimum information by mentally filling in the missing parts. We use modified version of the strategy to determine if a student understands a particular concept in question. By presenting the students with an incompleted computational problems, descriptive arguments, concrete proofs, algebraic manipulations, and geometric proofs on one side of the paper and list several completed solutions on the other side. Their task is to decide select the one solution that appropriately completes the problem and then justify their selection.

> We have been expanding the network with proposals like Dr. Mason's in mind. The software he need will be resident on the network. Students can use it on hardware throughout the school, including machines in the technology enhanced classrooms in accordance with Peter Sommer's plan for restructuring (See Middle School Restructuring Plan, pp. 147-149). The text materials were purchased as part of the operating budget of the school.

We feel that the added component to the existing program will offer the full range of mathematical process abilities[18] and at the same time preserve all that is good about the present curriculum.

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[18] Scandura, Joseph M., Mathematics: concrete behavioral foundations. New York:Harper & Row, 1971. Scandura lists the following mathematical processes: the ability to detect regularities, the ability to construct examples, the ability to interpret mathematical descriptions, the ability to describe mathematical ideas, the ability to make logical inferences, the ability to axiomatize, and the ability to combine them.

Social Studies

Archaeotype Review and Proposal:
Mary Kate Brown
Teacher, Sixth-Grade Social-Studies

1.0: Review of the year 1991-92

1.1: The Larger Vision

The 1991-92 school year was spent introducing Dalton to a larger vision. The implementation of this vision had a direct impact upon *Archaeotype*. New people, new ideas, new technology, new work spaces changed both the hardware upon which *Archaeotype* depends and the relations among members of the development team itself. The team work among scholar/teachers and technocrats directed at the perfection of old and development of new software was profoundly altered.

1.2: The Broader Impact

The year 1991-92 saw the *Archaeotype* team, their students and their colleagues presented on national public television as an example of all that is right in technology aided instruction. Moreover, the members of our group provided information, commentary, assessment and free advice to a myriad of visitors interested in observing our students working with our materials on the cutting edge of primary and secondary instruction. Finally, in the interests of sharing information and inviting peer criticism we presented several papers describing our assessment of the *Archaeotype* software at international symposia.

1.3: Institutional Response

On October 7th, 1991 we recommended the creation of a Coordinating Committee made up of Mary K. Brown, Luyen Chou, Neil Goldberg and Frank Moretti. The group, absent Mr. Chou, has worked through weekly meetings to ensure the substantive utility, academic integrity, consistency and uniformity of design consonant with the disciplines of Archaeology, History and Parkhurstian Pedagogy. The Committee plans the overall development of all site simulations and teacher modifications undertaken within the school. It oversees the manner in which materials from foreign disciplines are integrated into the excavation simulations as interest in the far reaching applicability of the Archaeological metaphor as a teaching tool grows within the academic community.

1.4: Approach to History

Members of the Coordinating Committee spent much time planning an integrated approach to History, one that stresses linear sequence, consistency of historiographic process and method and geographical breadth. By studying carefully chosen original sources in depth each student will develop for himself a view of the many strands that make up histories' narrative fabric. Consequently, the Committee devoted many hours to discussing which materials might prove the most enlightening for students. The recommendations that were adopted are as follows:

1.5: Choice Moments in Time

1.5.1: *Til Barsip* in North Syria, a provincial Assyrian site of the first half of the first millennium BCE, gives a splendid opportunity to study the inter-ethnic dependencies of the Levant, situated as it is between Africa and Asia in the early Iron Age. We are now deeply involved in the development of this simulation.

1.5.2: *Classical Greece*, already in its second year in the classroom needs no justification as it is at the root of modern Western culture. For this site we proposed to develop and test an assessment tool consistent with Bank Street College's observations of student performance in 1990-91 despite the changed conditions under which the program was being used.

Moreover, we developed a small "reverse" excavation for use with last year's *Archaeotype* graduates on the assumption that substantial exposure to technological tools would predispose students to continued sophistication in their approach to historical data. That proved to be the case. The aborted "1492" project was replaced with four student-created colonial American excavations using *Archaeotype* as a model. It is worth noting here that Faculty from Friend's Seminary have requested the use of this particular material.

1.5.3: *Eboracum*, a late antique site in Roman Britain, was chosen for many reasons. In the first place, the site is well excavated, well known and spans many centuries. This cultural spread allows the student to see the Celtic culture that once covered all of Europe gradually give way first to the Roman and then to the Viking, Angle, Saxon, Norman etc. Geographically the site represents the opposite extreme of the Roman Empire from Assyria. This helps the student gain some sense of the spread of people and culture over long distances and great spans of time. A Parthian legion from modern Iran is known to have served at Eboracum. The late antique leads directly into, indeed may be said to be, in many respects, an example of mediaeval culture.

1.6: Rejections

After considerable discussion the Committee rejected the choices of Tikal and Caesarea Maritima as respectively inconsistent with the direction of the overall program and excessively focused on the Middle East.

1.7: Technological Support of Classroom Scholarship

1.7.1: Implementation of *Archaeotype* in the classroom continued to be hampered by the need for ancillary software. The necessity for an illustrated and illustratable time line has been recognized since the early stages of our development of *Archaeotype* itself. The need for both teachers and students to add text to image is acute. That the larger world recognizes this need may be seen from the fact that the new Louvre video disc allows one to add annotations to objects and thus directly instruct students even in one's absence. The need for students to see the objects upon which they are working in relation to other historical events and artifacts is acute. Proper seriation and an understanding of the order in which events are generally agreed to have taken place is the student's weakest skill .

1.7.2: Additional technological development is needed to support scholarship in the classroom. The Museum function of the original program does not work properly. The museum was designed to serve as a multi-user tool. It never adequately did so.

Without such an information sharing device too much emphasis rests upon the teacher. A weekly symposium becomes a potentially boring necessity rather than an exciting matter of choice. This need to large numbers of continuing symposia impedes work in the library, visits to the Metropolitan Museum and conferences with specialists.. Without the Museum as an interactive communication device students become dependent upon their faculty for sharing information and are robbed of the very independence *Archaeotype* was developed to foster.

1.7.3: After much thought and discussion we determined to create successor programs to *Archaeotype* in color or gray scale. This will begin with the Assyrian site and proceed to the Classical Greek and Roman simulations, in that order.

1.8: Integration of Foreign Disciplines

1.8.1: This academic year saw somewhat more emphasis placed on Mathematical and Ecological questions directed at the Classical Greek excavation simulation. Studies in ratio, curvature, Cartesian gridding, Euclidean Geometry were the direct outgrowth of student's attempts to understand the historical materials with which they were dealing. Students debated and clarified questions of water supply, fuel source and soil productivity as the importance of physical geography to the Classical world and the trade upon which it depended became clear to them.

1.9: Education of junior and senior faculty

1.9.1: Our team of archaeologists spent much of their time during the school year familiarizing both old and new Dalton faculty with the newly deployed software, the generally agreed upon disciplinary methods, processes and objectives upon which the software depends and the authoritative textual sources and ancillary media they might fruitfully consult in the event of need.

1.9.2: We also began the controlled customizing of the software that will give each faculty person using the package a chance to emphasize some of those aspects of History of greatest interest to him or her. Such customizing is necessary because all teachers mold materials to their own interpretations. When dealing with material as discipline bound and process oriented as that of

Archaeotype we believe that specific opportunities for guided modification should be offered every faculty member.

1.10: Summary. 1991-92

The academic year 1991-92 proved to be a year for research, thoughtful planning and adjustment to change. It is our expectation that 1992-93 will find the core team implementing many of those goals that it took such care and caution to develop.

2.0: Goals for 1992-93

2.1: Technology Related

2.1.1: The two most important technology related items missing from the *Archaeotype* program are a multi-user "Museum" and an illustrated time line to which students can add their own words and images. The lack of these tools hampers the clarity of student understanding substantially. The "Museum" and the "Time Line" represent our first priority in technological completion of the program .

2.1.2: Once these items have been introduced into the classroom we will address the question of developing a "Notebook" in which each student collects his /her data, both text and image, and keeps track of the reading of original documents that he or she has done. Here also we would have the student keep records of a self-assessment of his/her reading of important historical texts.

2.1.3: We will add a "Day Book" to the program. Every artifact excavated is logged into a central "Day Book" and given a number in a pre-determined sequence. The students may consult this "Book" each day before beginning to excavate in order to familiarize themselves with all previously excavated artifacts presented in chronological order. The availability of such a tool will facilitate the growth of the students' independent control of the overall picture as it develops.

2.1.4: Finally, we have concluded that writing skills are facilitated by the addition of a small program that helps students develop reasoned arguments at the visual or image level. A simple form of this is now in use in the classroom. However, a more elegant, computer based version will be helpful not only to Social Studies classes but across the curriculum because the form of an essay, thesis plus substantiating argument is everywhere the same. Moreover, the availability or this "structure" will help students organize and present their conclusions either in standard essay format or some electronic medium.

2.1.6: Consistency of opening and closing of windows within the program is lacking. This error will be rectified.

2.1.7: As we reach the end of the year we may study the feasibility of introducing some on-line help for teachers and students. For the moment e-mail will greatly help make expertise available to all faculty using the program. Finally, we may begin to develop our own equivalent of "Beneficent Big Brother" that will allow the scholar/teachers to observe students at work. Such a tool should substantially facilitate assessment.

2.2: Goals for Curriculum Development and Deployment

2.2.1: The Roman Empire at its height stretched from the Persian Gulf to Britain. The three excavation simulations now in development, Til Barsip, Classical Greece and Eboracum, will do the same. The overarching purpose of our efforts in the curriculum area is the development a vertically integrated series of products that are historiographically correct, supported by a software environment custom tailored for the Dalton student regardless of age or grade level. This lack of restriction to grade level is possible because we are presenting images as the main objects of observation. Texts are restricted almost entirely to the libraries where they may be interchanged at will.

The images do not derive their meaning the text book that is accessible only to one grade level of student. The student himself derives meaning from the image directly by guided observation and interpretation. He uses neither the teacher's nor the textbook's descriptive and evaluative vocabulary, rather his own He is not barred by artificial age and grade stratification from access to the object's implications for narrative history. The process of observation and its object is the same whether the student is a freshman, a senior or a research fellow. The only limit to the level of interpretative sophistication is the student's own abilities and the virtuosity of his guide.

2.2.2: Geographical Matrix

Picture a course made up of a series of map overlays. We begin in the South of Iraq with Sumer. At the northern end of the Tigris-Euphrates flood plain is Akkad, the first Semitic Empire in the ancient near East. Amalgamating Sumer and Akkad, expanding to the Mediterranean via the Orontes Valley, controlling the Levant and the ancient kingdom of Egypt, is the Assyrian Empire. This is the Empire that, taken over briefly by the Babylonians and completely by the Medes and Persians, becomes the Persian Empire the antagonist of almost mythic proportions of Classical Greece. These are the boundaries inherited by Alexander the Great. These are the boundaries he expands to include mainland Greece and the Indian sub-continent as far as the Indus River. These are the boundaries that the Romans expand to include Western Europe south of the Rhine, Spain and the British Isles north as far as the Firth of Fourth. Maps will be used to show children the course of Empire.

This series of maps is in process of development. It will firmly ground students in the geographic expansion of civilization in pre-Christian and late antique times. It will, moreover, lead directly an understanding of the spread of Islam, the Ottoman Empire and the Mediterranean exchange networks prior to the shift to the Atlantic seaboard with the emergence of Portugal, Spain, Holland and England as world powers. Should time permit and material prove accessible we will add videos showing landscape and geography of the various areas studied.

2.2.3: Temporal Matrix:

The end of the second millennium BCE saw the fall of the great Empires; the lands of Hatti and Egypt were virtually destroyed. Troy, that great city of legend, is no more. The sea-coast of the eastern Mediterranean is without an overlord; Palestine is briefly free.

The Phoenicians, the Hebrews and the Philistines provide the stuff of legend; David slays Goliath; Hiram of Tyre sends cedar to Solomon who builds his Temple from the imported wood; Samson is unable to resist Delilah and brings down the house; the Philistines capture the Ark of the Covenant but, terrified by its power, quickly return it to their neighbors, the Israelites. These stories and others of the late Bronze and Early Iron Age such as that of WenAmon who takes a shopping trip from Egypt to Phoenicia will be read by the students in abbreviated form as a prelude to beginning excavations.

How long will these petty states that recorded these famous tales remain free before the shadow of another great Empire overwhelms them?

2.2.3.1: *Nimrod, the Mighty Hunter:* The physical remains of the Neo-Assyrian Empire are among the most spectacular produced by the ancient world, on a par with those of Egypt, China and Greece. Large scale stone sculpture and bas reliefs mirror some of the earliest examples of political propaganda extant. We see the king in battle, on the hunt and at prayer. Moreover, we hear that king in his own voice tell the story of these, his sacred acts. For Assyria has preserved more of the ancient world than awe-inspiring demons of basalt. Among the marvels of antiquity saved for us by the desert are the great libraries of Nippur, Nineveh and Ebla. What vocabulary, both verbal and pictographic, do these men use to present themselves and their doings? To whom did their annals speak? Who was the audience for their reliefs?

Since the iconography of the Assyrian palace reliefs is generally inconsistent with the ecology of the region as we know it today and as we believe it to have been at the time of the Empire some important factor must have encouraged the Assyrian kings to carve and paint flora and fauna that they rarely if ever saw. What was that factor? Both the texts and the reliefs give us detailed descriptions of the flora and fauna of the time. Thus Assyria gives us as an excellent opportunity to study subsistence bases and their relationship to religious practice, and political, military and economic institutions.

We may also here consider the discontinuities between what the historian expects to discover at a site and what is actually found. In Assyria understanding of the past is an imperative both for the ancient king and for the modern historian.

In the environs of Til Barsip on the upper Euphrates, on a main ford across the river, athwart the great trade route from Susa to the Caucasus and the Levant as you march West on your way to the Mediterranean where generations of Assyrian rulers "washed their swords" is the first site simulation.

To the degree that it can be said that research is ever finished it is nearly so for the site of Til Barsip. Most of the necessary bibliography is at hand. The remainder is known and either on order or awaiting purchase or Xeroxing. The year will see the accumulation of images, both artifactual and geographical, their scanning, already well under way, the addition of a "textual" library to the excavation and the deployment of the simulation in at least two sixth grade classes. Specialized libraries will take at least the remainder of the year to complete due to the difficulty of the material and peculiarities of publication. Reliefs from the great palaces will form the backbone of the historical sequences. These will be well structured and set out by October 1992. Arms and armor will be complete by that time. Architectural sequences of palaces and temples should be completed at the same time as will edited, paraphrased and summarized Akkadian texts.

Cylinder seals may be completed in time for use this fall. However, ivories, our main example of the international African, Asian vocabulary, will probably not be complete due to temporary inaccessibility of the main publication. The small wall painting library will be complete.

2.2.3.2: *Classical Greece:* With respect to the Classical Greek site we will introduce an illustrated time line, a day book, a multi-user museum, a student notebook and improved sculpture and architecture libraries. In addition, we will translate the entire program from its current format to gray scale or color. These changes will be deployed by January 1, 1993.

Within the program itself we will remove boxes with inscriptions in them and substitute inscriptions on store to be prepared for us by members of Dalton's foreign language department. We will attempt to develop substitute modules of five to ten objects each to satisfy the need to customize by various faculty members.

2.2.3.3: *Integration of Other Disciplines:* We expect to attempt this year to integrate materials from the language arts into the study both Ancient Greek and Assyrian culture. It should be self-evident that the skill involved in reading a primary source must be taught and that an understanding of such sources is a prerequisite to the full understanding of any literate culture.

Discussions have begun with members of the English department aimed at the substitution of genuine classical texts for some of the modern paraphrases of Greek myths now in use. We are considering the use Simone Weil's study of the *Iliad* as a poem of force as well as various works of drama.

The annals of the Assyrian kings are now being translated, paraphrased and summarized for the use of our students. Various myths and legends may also be made available this year should time permit.

We will continue to actively search out opportunities for the application of Mathematical models to classical materials. We shall continue to encourage students to think about natural resources, climate and demographics when developing explanations for events and artifacts. This is particularly important as we focus on how Greece and Assyria, both resource poor environments met this challenge.

If time permits we will provide students with topographical, climatic and political maps of Greece, North Africa, the Islands, Turkey and the Levant.

2.2.3.4: *Roman Britain:* In A D 125 the emperor Hadrian began to built a wall across the whole of Britain to keep the savage tribes from the north out of the civilized areas. A list of the homes of the garrisons stationed along this wall reads like a gazetteer of the Roman Empire. Men from as far east as the Tigris and as far west as Spain served their time along Hadrian's wall. South of this battlement is the modern town of York, ancient Eboracum, a legionary base and Roman colony. We have chosen this site because it is at the extreme end of the Roman Empire, an empire which represents the political, economic and social integration of the Mediterranean community. Its boundaries stretch from the Euphrates in the east to the Irish Sea in the west and from the Danube in the north to the Sahara in the south. It provided a forum for the articulation of African, Near Eastern, Classical and Celtic traditions. The cultural florescence emerging from this imperial articulation continues to shape our world even today.

The site we have chose is illustrative of this flowering of Roman imperium. It illustrates how easily and across what great distances one culture may influence another. Late Roman castra are reused in the middle ages as citadels to protect populations from marauders. Roman law courts are turned into Christian basilicas. Classical columns and pillars are reused in churches and cloisters. In those same cloisters live the monks who preserve for us the manuscripts of Greek and Roman literature.

This excavation will serve as the link between the very ancient past and the world of the mediaeval monk.

The fall and winter of 1992-93 will see the development of the scenario that will shape the Roman excavation. What questions are the most pressing for students to ask and answer? What aspects of Roman culture shall we emphasize in order to maintain a thread of coherence over such a long period of time? How does this site relate to the Celts who came before the Romans? How does it relate to the mediaeval culture that follows them? What is the difference between what archaeologists know about King Arthur and what poets say of him?

Late winter will see archaeologists collecting images suitable to support the agreed upon scenario and libraries. Books are now being collected that support the architecture and sculpture libraries. Interestingly enough dating can be done very accurately on Roman artifacts by observing the hair styles of the women. More emphasis will be placed here upon texts as many exist and students, having had most of an academic year practicing their reading, should be able to read them with more facility. Nevertheless experience tell us that a great deal of translation, paraphrasing and summarizing will still be necessary.

We hope to have an alpha test program in the classroom in late spring of 1993. To that end we will need substantial support after the first of the year.

2.2.4: Assessment

2.2.4.1: It is always more difficult to describe the good because when an operation is working smoothly it appears a seamless whole. Taking it apart is difficult and somehow jars the person asked to deconstruct a finely working machine. *Archaeotype* is no exception to this rule. Many, many classroom observations showed us small groups of students deeply engaged in their work, virtually oblivious to the observers watching them perform. Time on task is generally considered one of the premier criteria for the development of student mastery of a discipline. *Archaeotype* provides that to a degree rarely observed in any teaching tool.

2.2.4.2: This year an attempt was made to assess the students' progress on a long list of criteria many of which were derived from Bank Street College observations during the whole of academic 199091. Unfortunately those same observers were unable to continue their observations of the classroom this year. As a result, while there is no continuous outside observation available to us of the program's effectiveness as a learning vehicle, we do have our own lengthy observations of individual students based upon Bank Street's original observations.

2.2.4.3: The strength of student performances can be found in the development of writing skills: clarity, complexity, the ability to continually revise and synthesis. As we expected these skills were broadly evident, dependent as they are on clarity of thinking and practice in verbal argumentation. The program encourages much verbalization in both small and large groups. We expect that the adoption of an ancillary program described below, to be formalized this year, will enhance this aspect of the educational process and may also serve as a teaching tool for any student learning to substantiate a thesis in other disciplines.

2.2.4.4: Historical thinking, object analysis and historiographic skills such as the understanding of context, bias, authoritative sources, expert opinion and the like was a second strong area. None of these skills can be derived by the student from the software alone. Rather the understanding of each results from the emphasis placed upon it by particular faculty, all other things being equal. For this reason it is imperative that a teacher's guide with guided customizing alternatives be developed as soon as possible. For the moment we will continue to provide expert presence in the classrooms of less experienced teachers. The difference in quality of output by students is directly related to the academic training of the faculty using *Archaeotype* as a teaching tool and the openness of that teacher to working jointly with expert colleagues from other disciplines such as Math, Ecology and the like..

2.2.4.5: Historical skills represent the third strong area. Management of databases, museums and the like was easily and quickly learned by students. Less easily handled was an understanding of "authoritative" sources.

2.2.4.6: In the affective domain, group interaction was too dependent upon teacher feedback this year (See below under Technological needs.) Persistence in seeking expert opinion remained strong. Self-direction and respect for others were fostered by the pedagogy and developed substantially. It should be mentioned here that those few students who need authority figures to define what it is necessary and sufficient for them to know at every turn have some difficulty in working up to their ability level in this environment. The occasional child of this type if not given a specific and clearly spelled out corpus of data to master will not work to any great degree and will need ongoing guidance in taking responsibility for his or her own learning.

2.2.4.7: The ability of students to understand chronology is directly related to the availability of a student created, illustrated time line. Such a device allows students to place their findings in chronological order and understand visually how their work fits in with the larger picture we call narrative history.

2.2.4.8: To fully realize the potential of the *Archaeotype* program it is necessary that students and faculty alike have access both to authoritative sources and the latest works of known professionals. Our need is therefore to broaden and strengthen our library resources. Books such as "Blacks in Western Art" and "The Cambridge Ancient History" may serve as examples. The consequence in the classroom, of course, is a wider slice of artifactual history and consequently a more inclusive picture of antiquity.

2.2.4.9: The importance of the Metropolitan Museum's collections and access to its galleries can hardly be exaggerated. The number of observations that could be done in the Museum under the guidance of qualified scholars teaching students both alone and in tandem with a less specialized colleagues directly affects the students' ability to comprehend the archaeological record. This program relies heavily on teaching a process of observation, an approach to information, artifact and text; it is thus imperative that these early exercises in historical method be carried out. The process of observation applied to real artifacts in the Museum is the same process of observation that is used throughout the student's career in history. This is the scaffolding from which for all further approaches to course materials depend must receive as much support from the administration as possible.

2.2.4.10: To fully realize the program's academic potential and offer a variety of expressive media to our students it is valuable to have a person instruct students in the development as use of HyperCard as a medium for the presentation of ideas. Our current plan is to have classroom time devoted to student instruction by a computer specialist working under the direction of the classroom teacher. In addition we will be developing and deploying a program that enables students to write effectively both in standard essay form and in the hypertext medium.

2.2.4.11: Outside, peer review is always desirable. This year's document presented by Mark Petrini, Professor of Classics at Columbia University, proved an invaluable tool for self-assessment. We propose to continue to solicit the opinions of outside consults in or effort to maintain a self-critical posture.

2.2.5: Resources for Faculty

We expect to continue providing materials and guidance in person to those faculty who wish to continue to customize the excavation to suit their own interest.

2.3.0: Budget Narrative

2.3.1: Summer Months

2.3.1.1: The summer months (last half of June, July and August) see a proportionately greater expenditure of funds because of the greater availability of scholar/teachers, specialists and student aids and the concomitant disbursement of monies for working materials such as books, Xeroxes, photographs, visual aids etc. Let this summer serve as an example.

2.3.1.2: We now have working on the project two full time archaeologists for the months of July and August, an increase of two man months over what had been anticipated. In addition, we have employed a 3/5 time architect to draw the mud brick buildings of the Assyrian palace and temple and assist in the clarification of some of the architectural features of the Greek site and its architecture library. In addition, the map sequence that will introduce the course will be done by our architect.

2.3.1.3: We have retained the services of one additional specialist, an ecologist, because work with pollen samples, horn cores and the like is better carried on by a professional. Moreover, the whole development of early civilizations in the middle east now is thought to result from an adaptation to a resource poor environment.

2.3.1.4: We have a junior Social Studies faculty member doing guided research and producing précis of scholarly materials related to the perception of modern day minorities in antiquity. This is part of our plan to develop "custom" units for inclusion in the program at faculty request.

2.3.1.5: Furthermore, we have been able to obtain the services of several Dalton students who have done everything from Xerox journal articles to scan images and help create extensions of the computer based libraries.

2.3.1.6: Summer also has meant substantial expenses for specialized books and journals, photographs and copies of out of print or unobtainable materials. These types of expenses will continue through the fall and winter months.

2.3.1.7: We have a full time programmer-designer devoting one and a half man-months to the project this summer. In addition, the cost of eight Macintosh IIsi's to run the programs will shortly be incurred .

2.3.2: Academic Year

2.3.2.1: During the school terms (September through June) we will incur costs for a half time archaeologist and a one third time archaeologist plus the 10% of their salaries now being charged to the project in consideration of the work that they do outside the classroom. We will also incur the cost of replacing one third of an archaeologist in the classroom. This can be done by the junior faculty member now working on the project. We will continue to require the services of the architect to help develop the Roman and Early Christian buildings for Eboracum and to create the plans and sections of the Roman castrum that will serve as the backbone of the site.

2.3.2.2: Travel expenses will increase because of the necessity of visiting both York and the British Museum in preparation for completion of the Roman site. In addition the Louvre in reopening its Ancient Near Eastern galleries this fall after four years. Many of the items in the Til Barsip site are housed in the Louvre because the original excavator, F. Thureau-Dangin, was a curator there. Direct observation is always preferable to photographs when studying artifacts. It would improve the archaeologists' own understanding of the site to see many of the items in the original.

2.3.2.3: Occasional research excursions to the University Museum at the University of Pennsylvania and to the Boston Museum of Fine Arts will also take place.

2.3.2.4: Our ecologist will remain with us throughout the academic year on a one or two day a week commitment teaching students directly about her field.

2.3.2.5: We may also incur the expense of the classroom replacement for a one third time Math instructor who has been working to integrate Math into the *Archaeotype* program during the past year.

2.3.2.6: The programmer will work twenty hours a week on *Archaeotype* during the academic year. The number of new tools needed to properly deploy the programs we have developed is substantial and will require uninterrupted attention to task. In addition, because we have another beta test program, Assyria, running in at least two classrooms the programmer will need to be present much of the time both to the deal with program glitches and to observe and instruct students in the use of both the program and HyperCard .

2.3.2.7: It is our recommendation that if the call by other New Lab projects on our programmer-designer is as heavy during the coming year as it was during the past that we retain the services of an outside programming specialist and rid ourselves of some of these ancillary programming requirements about which we have been talking for well over a year.

2.3.2.8: It might well be noted here that this past year we had no time devoted to student instruction in HyperCard, a service performed by our programmer-designer in previous years, despite the fact that he was scheduled to perform this task. As a result the students' HyperCard presentations are in no way comparable to those produced by the previous year's students. Nor was the class able to observe the development team, a group of adults working in tandem toward a shared goal as they had the previous term. Lack of models did not help them develop cooperative learning and working skills.

2.3.2.9: Finally, if it is possible to retain a student or two for perhaps five hours a week each to Xerox, pick up journal articles at Columbia and scan photos and texts that will be all to the good.

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Archaeotype 1992:
Carolyn Karp
Teacher, Sixth-Grade Social-Studies

This year was my second consecutive year using *Archaeotype*. The experience was more relaxed this year for me and my class as a result of my familiarity with the program.

I have used the program as an outgrowth or culmination of the Greek unit in history. Therefore my class has already had the basic understanding of the chronology of Greek history and some underlying concepts of the people and their culture before they begin *Archaeotype*. It is consequently difficult for me to assess the effect of *Archaeotype* per se on the class' knowledge of history since the students come to the program with (hopefully) some pre-existing knowledge.

- The group as a whole this year was enthusiastic about starting the project. They look to the computer very quickly and truly enjoyed interacting with the machines and the program.
- All of my four groups were called and selected by me according to academic and social heterogeneity. Some groups were more successful than others as a result of better interaction among the members. Group dynamics are key to the success of each quadrant. Some chiefs are better able to organize, develop and encourage their co-workers than others.
- As teacher/resource person, I felt prouder of the achievements of several groups than of others. Some groups with highly motivated members took pleasure in exploring all databases and enjoyed using Perseus and the Louvre especially. Others needed more prodding to leave the computer to do further research in the library or on other databases.
- Weaker students with less developed historical interests had trouble sustaining interest in prolonged research on a single object, no matter how much encouragement or feedback I gave.
- My strongest groups began exploring HyperCard and were very satisfied with their results.
- The best and the brightest students, as well as the average students, were all able to benefit from *Archaeotype* on their

level. Every student attained a level of competence with the computer and learned to relate history and artifacts to a degree probably not achievable without this excellent program.

- The quality and quantity of the resource people, books, and materials in the Dalton libraries and in the classrooms make the program especially successful at Dalton. It is essential to continue stocking the library with materials which the students can have access to so that their learning can continue both in and out of the classroom.
- *Archaeotype* remains an exciting, innovative program that makes history come alive for students. It allows sixth graders to feel they have participated in an archaeological dig and have made discoveries both physical and intellectual of which they can be justifiably proud. I have enjoyed my *Archaeotype* experience and consider myself fortunate to have such an outstanding program to bring to my class.

* * *

Digging History: *Archaeotype* and the Development of Historical Reasoning:

Bill Tally & Margaret Honey
Bank Street College of Education

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Introduction

In a 1991 study of fifth graders' ideas about history, researchers at the Institute for Research on Teaching found that few students understood the degree to which history is an interpretive discipline, and further, that they knew little about how historians work, "tending to confuse them with archaeologists."[19] If the fifth graders' image of archaeology was the widely shared one of a pith-helmeted specialist digging for factual, objective nuggets of what happened long ago, historians have reason to be alarmed at the comparison. In fact, however, archaeology is a disciplined way of knowing about the past, and can provide a useful model of historical reasoning at its *most* interpretive and analytical. This paper is about a group of sixth grade students who learned to approach history in an interpretive way precisely by adopting the role of archaeologists, with the help of a prototype computer program called *Archaeotype*.

The *Archaeotype* Program

Archaeotype is a program that combines aspects of both a simulation (organizing learning in more active, motivated, and real-world ways), and a hypermedia database (modeling, through a network of linked information, the intellectual procedures characteristic of a discipline, in this case, archaeology).[20] Created

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19 Brophy, J., VanSledright, B. A., & Bredin, N. (1991). Fifth graders' ideas about history expressed before and after their introduction to the subject. Elementary Subjects Center Series No. 50. Michigan State University, East Lansing.

20 Simulations and hypermedia are two multimedia genres that show a great deal of promise for teaching and learning. Teachers have long used classroom simulations to organize learning in more active, motivated, and real-world ways, so it is not surprising that many computer-based simulations have proved popular as classroom tools (Genetics Explorer paper). Hypermedia, defined

by teachers, administrators and programmers at the Dalton School, a private school in New York City, *Archaeotype* was designed to deepen sixth-graders' study of ancient Greek history and culture.[21] The program is a networked simulation of an archaeological dig, and includes four virtual environments: an archaeological site, a laboratory, a library, and a museum. The artifacts "buried" in the site are digitized images of sculpture, pottery (complete with paintings and text fragments), armor, weapons, jewelry, and coins. Working in teams of 3 or 4, students recapitulate what archaeologists actually do: they excavate artifacts, weigh and measure them in the lab, sort through libraries of images and texts to help identify and interpret them, and finally, contribute their curated artifacts to the museum, a resource shared by their "colleagues" in other groups.

Pedagogical Objectives

In the winter and spring of 1991, *Archaeotype* was the core of an ambitious effort to reshape Dalton's sixth grade history curriculum on Ancient Greece.[22] The program's developers -- two

broadly as a network of linked texts and images, is a more recent arrival, and has been used primarily towards cognitive aims -- for example, to help students acquire the intellectual skills characteristic of disciplines such as literature and science (IRIS papers). Yet we know little about what students actually learn from working with these new programs.

[21] The development of Archaeotype is an interesting case study in collaborative, in-school curriculum design via multimedia. Each of the people involved brought distinct expertise and a perspective that shaped the program and its implementation in important ways. For an account of the design process and the roles played by teachers, administrators and programmers, see Honey, M., & Tally, W., Archaeotype: Collaborative Multimedia Development in the Dalton School. (In preparation)

[22] Considerable resources were mobilized in support of this effort, including technical equipment (4 MacSE/30s linked to an SE server with an 80mb hard drive) staff (curriculum specialists, programmers, librarians, and high school teachers of classics and ancient languages were asked to be available to students), and materials (the high school library collections, and supplemental videotapes and videodiscs, were also made available). The Archaeotype program was written in Silicon Beach's SuperCard.

teachers, two administrators, and a programmer/designer -- each had their own goals for *Archaeotype*, but they shared the overall aim of creating a more *constructivist* approach to history. In contrast to traditional history education, in which students are essentially consumers of narratives that have been constructed in advance, *Archaeotype* was to enable them to become historians themselves, building and debating their own interpretations of the past, based on fragmentary, evolving evidence. The site was deliberately constructed so that the data might yield conflicting hypotheses, which students would present and debate in weekly colloquia. The goal, as one teacher put it, was to have them not just *learn* history, but *do* history.

Historical reasoning. The two teacher-developers were themselves Ph.D.-trained archaeologists, and they saw *Archaeotype* as a way for sixth graders to practice archaeology's disciplined way of knowing about the past. Even more than specific content knowledge, they wanted students to learn *to think like archaeologists and historians*. Their primary concern then, was the development of historical reasoning. They hoped that the fragmentary nature of the archaeological record would force students into the role of interpreters, leading them over time: a) to build more complex and imaginative inferences about Greek culture, b) to support these inferences logically, using different kinds of evidence, c) and yet to recognize the ambiguities inherent in that evidence, and the essentially open-ended nature of their historical inquiries.

Content knowledge. Teachers also hoped that students' research into specific artifacts would lead them to learn about many of the key ideas, events, places and figures of Greek history and culture. But they deliberately avoided setting specific content objectives, since this seemed incompatible with the open-ended nature of students' investigations, and premature given the experimental nature of the program. But because larger issues of accountability loomed in the background, the question of what and how much students would learn about Greek history and culture was definitely on the minds of teachers and administrators.

Background / Research Context

As part of a 2-year study of multimedia curriculum development at Dalton, we set out to study student learning in the initial *Archaeotype* classrooms, focusing on students' development of historical reasoning skills.[23]

The traditional paradigm for research on student learning with technology involves keeping classroom conditions as constant as possible, changing the technology, and measuring the outcomes. At the Center for Technology in Education we are working under a somewhat different paradigm, one that acknowledges both the practical difficulty of controlling often messy and complex classroom conditions, and the ethical imperative for educators to intervene in multiple ways at once in order to effect meaningful change. We are collaborating with schools where significant efforts to improve teaching and learning are underway, and technologies are being enlisted as tools to help. Our approach is to document, through labor-intensive ethnographic protocols, the roles that technologies play as helps or hindrances in the reorganization of teaching, and then, to examine student learning as one outcome of those changed conditions. We use performance-based measures to study learning *in situ*, rather than experimental designs with pre/post or control group comparisons.

The pilot classroom

We began, then, by observing work in the pilot *Archaeotype* classroom daily over a 1 2-week period. A sixth-grade history class with 15 students, it met three times a week for 50 minutes, and a fourth time for 80 minutes. Roughly three days each week were

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[23] The Dalton School was chosen as a site for study not because it is representative of many other schools (its staff, class size, financial resources, and student body put it on the elite end of the spectrum of private schools), but because its ambitious investments in technology-based curriculum development, anchored in the New Laboratory for Teaching and Learning, make the entire school a laboratory for studying the role of multimedia in learning.

devoted to excavation and research, and one to classroom colloquia and museum trips. Two researchers took field notes of classroom interactions; videotaped colloquia where students presented their findings; interviewed teachers; and collected samples of students' written work.

What emerged was a rich picture of pedagogic change at the classroom level.[24] Briefly, *Archaeotype* appeared to motivate students' inquiries, support new working relationships between students and teachers, and mobilize a rich array of resource materials.

First, the archaeological simulation appeared to be a powerful means of motivating extended, self-directed student inquiry. Students routinely came to class early to begin excavating, and many spent lunch hours in the classroom as well. The unit as a whole was repeatedly extended, from six to eight weeks, to ultimately more than sixteen, as the momentum of student investigations, and the desire to present findings thoroughly, did not abate. From the outset, students' sense of ownership over knowledge was reflected in their frequent talk of "our artifacts," "our findings," and "my theory." It seemed clear that both the experiential and the visual aspects of the program contributed greatly to its success in motivating students.

Second, *Archaeotype* helped students and teachers work in a variety of shifting configurations and roles. Over the course of the inquiry, students functioned as team-members, dividing up the tasks of excavation, research, and interpretation; as independent

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[24] On a typical day, students would arrive early to begin work at one of the four networked Macintosh SE/30s, each of which gave access to one quarter of the site. If one team-member were to begin excavating and measuring artifacts, another might plot the previous day's finds on a site map, while two more went to the videodisc workstation with print-outs of artifacts they wanted to find out more about. Other groups might be working in the library. Students frequently sought advice from teachers, who moved about the room prodding them with questions, suggestions, and ideas for resources to consult. The room often grew noisy with printers, students and teachers all working at once. Occasionally the teacher would stop the students' work and prompt them to consider some idea that she had noticed many were missing.

researchers, consulting resources and teachers throughout the school; as colleagues, sharing findings and arguing over interpretations with members of other teams; and as authors, writing summary monographs on an aspect of Greek culture.[25] Teachers, no longer responsible for motivating and organizing student activities on a day to day basis, were able to function as intellectual coaches, guides to resources, content experts and, where necessary, as co-investigators.[26]

Third, *Archaeotype* helped mobilize students' use of a wide range of resources throughout the school, and beyond. Students consulted on-line libraries of images and texts, videodiscs on classical art, library books on Greek history and myth, teachers in archaeology, philosophy, and ancient languages, the computer programmer, and the collections of the Metropolitan Museum. To build their interpretations of individual artifacts and the site as a whole, they collected print-outs of their finds in group portfolios, plotted their data on site maps, and annotated both of these. Over time, students made increasing use of visual resources like maps and timelines, as they struggled to make sense of increasingly complex data. Finally, for several groups, the inquiry culminated in the writing of HyperCard documents that grouped and linked their own and other's findings in multiple ways, representing their

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[25] The need to cooperate in each of these roles led to friction and difficulty at times, as students struggled over problems of decision-making, equal responsibility, and communication, but most were capable of resolving differences, either on their own, or with small interventions from the teacher.

[26] It may be that in the truly inquiry-driven classroom, no one is safe. Even the programmer and the researchers, on hand to observe students' use of the software, became drawn into the inquiry: the programmer found himself teaching the students first math, then programming; the researchers, in asking questions, found they were helping students make sense of their research. Occasionally the new role thrust on a participant created challenges that were difficult to meet. Librarians, briefed that students would be coming to them for help, were ill prepared to help students who wanted to find out about an image they had uncovered, and were unable to verbalize in advance the category "Assyrian sculpture" in which it belonged.

conclusions visually and experientially, as well as textually.[27]

Teachers in the pilot classroom

These developments were not the result of the technology *per se*, of course, but rather gradually emerged from the *culture of inquiry* that the technology helped establish. This culture owed a great deal to the core teacher in the pilot classroom, Ms. Brown, and the social studies curriculum specialist who was her partner in the development of *Archaeotype*, Mr. Goldberg. Both Ph.D. archaeologists, they performed several kinds of work that were critical in scaffolding students' inquiries. First, they had spent nearly a year in creating the site and the on-line libraries, and knew the material thoroughly. In addition, Ms. Brown had prepared students for the visual dimension of the program in repeated trips to the Metropolitan Museum, where they studied bas-reliefs in order, she said, "to learn how to look."

In the classroom, Ms. Brown and Mr. Goldberg played especially crucial roles in *coaching* students and in *context-building*. As coaches, they helped kids clarify their purposes and achieve focus and direction, by offering specific information, helping them ask better questions, suggesting places to look for more material, and also by modeling the inquiry process in concrete ways, for example by explaining how to annotate a

[27] The program, of course, did not always work as intended. The Museum component, for example, was to be a shared resource through which students would review each other's findings and communicate by leaving notes; in fact, the software design, which limited use of the Museum to one group at a time, discouraged its use, and in any case, inter-group sharing and communication happened more spontaneously and effectively in the classroom itself, over print-outs of artifacts and site maps. Students also found the note-making space in the Laboratory constraining to work in; most preferred to write on their print-outs, or on other sheets of note paper, that could then be more readily transported and shared. There were also, of course, considerable technical problems at the outset, which necessitated regular visits from the programmer and a technician. The programmer's presence eventually led some students to ask him about modifying the program; these students became the first to decide on HyperCard as a presentation medium, again calling on the programmer's help, and inspiring others to do the same.

print-out of a frieze. As context-builders, they helped kids step back from their immediate aims in identifying their artifacts, to consider emerging patterns in the data, the evidence gathered by other groups, connections to other knowledge about Greece, and the macrorelations of time and geography. In these roles, both Ms. Brown and Mr. Goldberg drew heavily on their considerable knowledge of the art, artifacts, culture and daily life of the ancient world. Finally, the teachers helped students work through the communication problems that not infrequently arose within and between groups, as they negotiated roles, responsibilities, and decisions.

Apart from her unusual content expertise, Ms. Brown also brought to the experiment a teaching philosophy and style that were already far from traditional. She believed in teaching large, general ideas only through concrete, historically specific events and documents, and further, was adept at using the Socratic method to draw critical reasoning out of her students.

What did students learn in the pilot *Archaeotype* classroom? Our observations seemed to indicate that students were making more sophisticated inferences about the site over time, and supporting them better. But Ms. Brown's unusual background and skills, and the large role she played in scaffolding students' inferences, would have made it difficult to attribute gains in reasoning ability to the presence of *Archaeotype*. Accordingly, we decided to focus more intently on student learning in the next implementation of the program.

The test classroom

After the apparent success of *Archaeotype* in the pilot classroom, the program's use in the next two sixth grade classes was considered a test of how well it would transfer to other settings. *Archaeotype*'s developers wondered whether the program's learner-centered pedagogy would take root in more structured classrooms, and whether other teachers would be hampered by their relative unfamiliarity with the program's contents and the domain of archaeology. Questions about how much history students were learning still hovered in the background, but they were not as urgent, since the two new classes had already covered the curriculum on Ancient Greece. Indeed, this helped reduce any pressure on the new teachers: their students already had a background knowledge of Greek history and culture; *Archaeotype*, for them, was a supplemental activity.

We decided to track student learning in one of the two new classrooms, reasoning that if changes in students' thinking could be documented here, *Archaeotype* would clearly have played a shaping role. The new teacher, Ms. Karp, differed from Ms. Brown in several ways. She had played no part in the creation of the materials, had never used technology to any significant extent, had no prior commitment to a learner-centered style of teaching, and no advanced expertise in the area of Greek history and archaeology.

We observed four groups of students, 14 in all, using *Archaeotype* over a six week period. As in the pilot classroom, the students worked at four computer workstations to excavate, weigh and describe their artifacts, plotted them on site maps, and researched them using books, maps, timelines and videodiscs in the classroom, and consulting teachers, and the students in the pilot classroom, for advice and help. As in the pilot classroom, we gathered field notes of student interactions with materials, videotaped interviews with students, and collected final samples of students' on-line writing. We also observed and interviewed the teacher for indications of how her teaching and her views of history and classroom process might have evolved through the use of the program.

Teacher change in the test classroom

Despite some initial trepidation about using the program (the precedent set by Ms. Brown was more than a little daunting), Ms. Karp actively shaped the way the program was introduced and used in her classroom, and also, in the process, was shaped by it. She rearranged the workstations so that groups had more privacy and could work in more organized a manner; she created mixed-sex groups, against the advice of Mary Kate, in order to see how they would work; and she introduced the program as a supplementary activity, one that would allow students to have fun with what they'd already learned studying ancient Greece.

In using *Archaeotype*, Ms. Karp decided, almost as an experiment, to relinquish her usual, highly directive teaching style. Once she saw that the students' work at the computer had a momentum of its own, she adopted what she called a "laissez-faire" approach, standing back from the work and simply making herself available to students as they needed her. In turn, she experienced herself in a new position as a teacher: no longer in command of all the knowledge her students were seeking (since the range of content in the program is much too large for any one person to master), she struggled to develop a different kind of expertise: that of an expert inquirer, able to help students ask good questions of the materials they were finding, and form plans for how to go about answering them. In addition to seeking specific information from Mr. Goldberg and Ms. Brown, she consulted with them on general problems of student-centered work, such as how to handle children's misconceptions. Finally, Ms. Karp reported that her new "laissez-faire" role allowed her to observe student interactions more closely, and that she was paying more attention to students who were having difficulty. Using *Archaeotype*, then, helped foster collaboration among teachers, and helped Ms. Karp gain insights into what was for her a new organization of learning .

Research Design

What did students learn in the test classroom? We set out to assess students' historical reasoning, that is, their ability to make original inferences based on evidence they identify themselves. Teachers expected that children's archaeological exploration would lead them over time to make more complex inferences about Greek culture, and to ground their inferences logically, using different kinds of evidence. In order to assess changes in students' reasoning over the course of the six weeks' they used *Archaeotype*, we videotaped interviews with each group twice, two weeks into the process, and again in the final week. The interviews took place in the classroom, and were relatively unobtrusive interventions, mimicking in many respects the weekly colloquia in which groups presented their findings to one another. Researchers began by asking students in each group to "Tell us about what you've found so far," and about half way through the interview, added, "So tell us what you think this all means." Students were animated in response, eager to share and make sense of what they had found. In presenting and supporting their interpretations students used print-outs of their artifacts, their site map, timelines and wall maps of the ancient world, citations and illustrations from books, and occasionally the computer. The initial interviews lasted an average of 20 minutes; the final interviews were closer to 35 minutes each.

Qualities of inferences, and scoring scheme

We analyzed transcripts of the tapes to identify *inferences* of two kinds: *interpretations of artifacts*, explaining what objects were, what they were part of, or what they were used for; and *hypotheses about the site*, explaining what structures, events, or people had existed there, when, and what they were like. Each inference was then scored on several dimensions: *complexity*, *use of evidence*, *integration of background knowledge*, *open-endedness*, and *originality*. These categories were derived from interviews with the teachers who created *Archaeotype*, and the assignment they wrote explaining the archaeology project to students. They are not the final word on what good historical reasoning is; rather, they represent the values shared by two history teachers, the *qualities of thought* that they believe distinguish a good archaeologist or historian. Each of the categories, and the coding scheme, are explained below.

Complexity. Student inferences were complex when they moved beyond simple descriptive accounts of objects to include more abstract ideas or groups of ideas such as temporal or geographic origin, or cultural meaning. Statements were given a score of O when they were simple or obvious descriptions ("This is a box with writing on it;" "People were here once"); a score of 1 when they involved a single idea ("We think there was a temple here"); a score of 2 when they involved two or more ideas ("There was a Corinthian temple here, probably around 525 B.C."); and a score of 3 when they connect artifacts and their cultural meaning in a layered, synthetic way ("There were two temples here, one Corinthian and one Doric, and in between there was a war that destroyed the first one, so they built the second on top of it").

Use of Evidence. The assignment that teachers wrote for the project stipulated that "logical statements based upon actual data either from our site or from comparable primary or secondary sources are necessary to substantiate every hypothesis."[28] An inference was given a score of 0 if students neglected to support it with evidence, or if evidence was used illogically; a score of 1 if they logically cited one kind of evidence (for example, weapons to support the idea of a battle, or the detail of a sun to support the idea that a pottery figure is Apollo); a score of 2 if they cited two or more kinds of evidence; a score of 3 if they referred to a *pattern* of evidence; and a score of 4 if they managed to cite and reconcile *conflicting* evidence.

Open-endedness. Both teachers felt strongly that "our knowledge of the past is open-ended," that "alternative explanations are possible," and that "you [should] continue to reinterpret ideas and objects long after you have excavated them."[29] Inferences were given a score of 0 if they were simple, definitive statements; a score of 1 if they were prefaced by provisional language such as "we think," or "I'm not sure, but...;" a score of 2 if alternative hypotheses are cited; a score of 3 if the interpretation or hypothesis is *revised* in mid-stream; and a score of 4 if a *new question* gets raised as an outcome.

Originality. Both teachers felt that imagination and originality are key elements of archaeological reasoning. Asked what would be the best possible student analysis of the site, they both said, in effect, "one which is unique and different from ours, yet logically supported by evidence." Inferences were given a score of 0 if they simply repeated common hypotheses or evidence; a score of 1 they emerged from original research; and a score of 2 if they showed

[28] Brown, M. K., Goldberg, N., and Moretti, F. (1991) The Ancient Greeks -- Lessons from the Soil. Unpublished assignment. The Dalton School, New York City.

[29] Brown, M. K., Goldberg, N., and Moretti, F. (1991) The Ancient Greeks...

creative or imaginative use of narrative, analogy or hypothetical reasoning.

Integration of Background Knowledge. Teachers hoped that students would become familiar with the many of the key ideas, events, and figures in the art, history and mythology of Ancient Greece. Inferences were given a score of O if they were accompanied by no background knowledge; a score of 1 if they integrated one kind of background knowledge ("That's the time of the Peloponnesian War;" "This is Hermes, he's the messenger."); a score of 2 if they integrated two kinds of background knowledge; and so on.

Results

The results reported here represent two groups of students, one with three girls, and the other with two girls and one boy. The groups were chosen to include children whose learning styles and abilities reflected the range of students in the *Archaeotype* classes. The groups emerged as roughly similar on the dimensions examined here, so the results summarized are aggregate.

In strictly numerical terms, inference-building by these students doubled from the first to the second interview, going from 17 to 34. The different kinds of evidence used to support interpretations and hypotheses also increased one and a half times, from 19 to 30. But these raw numbers say little about the *quality* of students' interpretations and hypotheses .

The *complexity* of inferences increased significantly, as the number integrating two or more ideas, or integrating artifacts and their cultural meanings, rose from 18 to 57 percent.

The *effective use of evidence* to support interpretations also increased, as the number of inferences supported by two or more kinds of evidence, a pattern of evidence, or reconciling conflicting evidence, rose from 20 percent to 74 percent.

The *open-endedness* of students' inferences changed more subtly. On the one hand, more definitive statements were made in the final interview, and fewer citations of alternative hypotheses, suggesting that students' thinking became less open-ended over time; on the other hand, students revised their hypotheses and raised wholly new questions more frequently in the final interview.

The *originality* of students' inferences appeared to increase over time, as the number of inferences showing creative use of narrative, analogy or hypothetical reasoning rose by a factor of three, from 12 to 36 percent.

Finally, the *background knowledge* that students integrated into their interpretations increased as well, with only 12 percent of inferences involving two or more kinds of background knowledge in the first interview, rising to 68 percent in the second interview.

Discussion

The *Archaeotype* classrooms we observed were part of an ongoing experiment at Dalton in building more constructivist, collaborative, and cumulative learning experiences for students. Teachers and administrators hoped that the structure of *Archaeotype*, as both a simulation and a hypermedia database, would aid children in adopting an archaeological perspective on the past -- one that emphasized interpretation, analysis, imagination, and logical use of evidence. If the simulation aspect of the program provided an *experiential* foundation, they hoped that the hypermedia components -- particularly the Museum and the Libraries, which were sorted in ways designed to subtly reinforce the concepts of typology and seriation -- would support students' *cognitive* development.

Our ethnographic data confirm that *Archaeotype* helped move the teaching and learning of history in both classrooms in a more constructivist direction. Students took charge of their own inquiries, felt a sense of ownership over knowledge, and used teachers as sources of information, guidance, and skill in asking questions. More important, teachers' hope that the archaeology project would lead students to reason more interpretatively and analytically seem to be confirmed by our data from the test classroom:

- *Students made more complex interpretations and hypotheses about the site and its contents*, integrating ideas of time and geographic origin, and discussing the way artifacts threw light on the culture of the Ancient Greeks.

- *Students demonstrated significantly more varied and effective use of evidence to support their ideas*, citing observed details, comparisons to other artifacts, primary and secondary sources, and patterns in the data.
- *Students were less open-ended about some of their ideas at the end of the project, and more open-ended about others.* Separating the data for interpretations and hypotheses shows that students were spoke with greater assurance about particular artifacts over time, and with a greater tentativeness in their hypotheses about the site as a whole. It is possible that the research students did in the course of the project helped them to "pin down" the artifacts (copies of many of which could be found in books students had access to); while the same research led them to an awareness of the multiple explanations possible for the data taken together.
- *Students' inferences were more original and imaginative at the end of the project*, perhaps because they had opportunities to do more independent research, to hear the ideas of different students, and to find ways of distinguishing their own group's conclusions from those of others.'
- Finally, and perhaps most striking in a class that had studied Ancient Greece in the traditional way before the project *began, students demonstrated command of significantly more background knowledge in their inferences at the end of the Archaeotype unit.* The background knowledge woven into their discussions included references to historical, mythological, and aesthetic ideas and information, from Alexander to Xerxes, Apollo to Zeus, and from Attican to Venician sculpture. It is possible that students in the test class did not actually *learn* more about Greek history and culture during this period, that instead they *drew more effectively* on their prior knowledge after spending more time with the data. In either case, however, the archaeological experience seems to have helped students find, organize, and integrate historical and cultural knowledge. Thus, the concern shared by many that constructivist pedagogy sacrifices breadth for depth of learning,

did not appear to be relevant to the *Archaeotype* classrooms.

What role did the technology play in these results? It is, of course, impossible to specify precisely. But of the two structural features of *Archaeotype* -- a simulation and a hypermedia database -- it seemed clear that the simulation acted as a powerful catalyst to motivate and organize students' inquiries, while the database played a relatively small role in their cognitive development. The virtual environments of the Museum and Library were important as repositories of information, but did not play a large part in scaffolding student thinking, in part due to software design problems.

In the final analysis, it was the *culture of inquiry* that *Archaeotype* helped promote, and not the program itself, that was responsible for students' progress in inference-building. The technology made it possible for the classroom to become a highly interactive environment, enabling student and teacher communication, collaboration and use of materials on an unprecedented level. The learning that occurred within those interactions was the result of the people involved, and their considerable effort and imagination.[30]

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[30] Not all groups and individuals, of course, showed the same degree of development in inference-building and the integration of content knowledge. Our field notes from both Ms. Brown's and Ms. Karp's classrooms indicate that at least three general factors seemed to be correlated with more developed inference-building: 1. Interactions with teachers. Much of students' inference-building happened in response to spontaneous prods and questions posed by the teacher and other adults in their roles as guides and coaches. Groups of students who persistently sought the teacher's and others' input were more likely to evolve complex inferences than those who worked without it. Adults also had different kinds of content interests and expertise, and this led them to support some students more than others, depending on, for example, whether the students' inferences were focused on Greek mythology or history.
2. Group communication and collaboration. A group's success in building more complex interpretations of the site seemed to vary in part according to how well the members communicated and shared information with one another, and with other groups. The more successful students actively sought information about what other groups were finding through informal discussions, and the borrowing of materials. Groups that could acknowledge and deal with the sometimes heated conflicts that developed over individual

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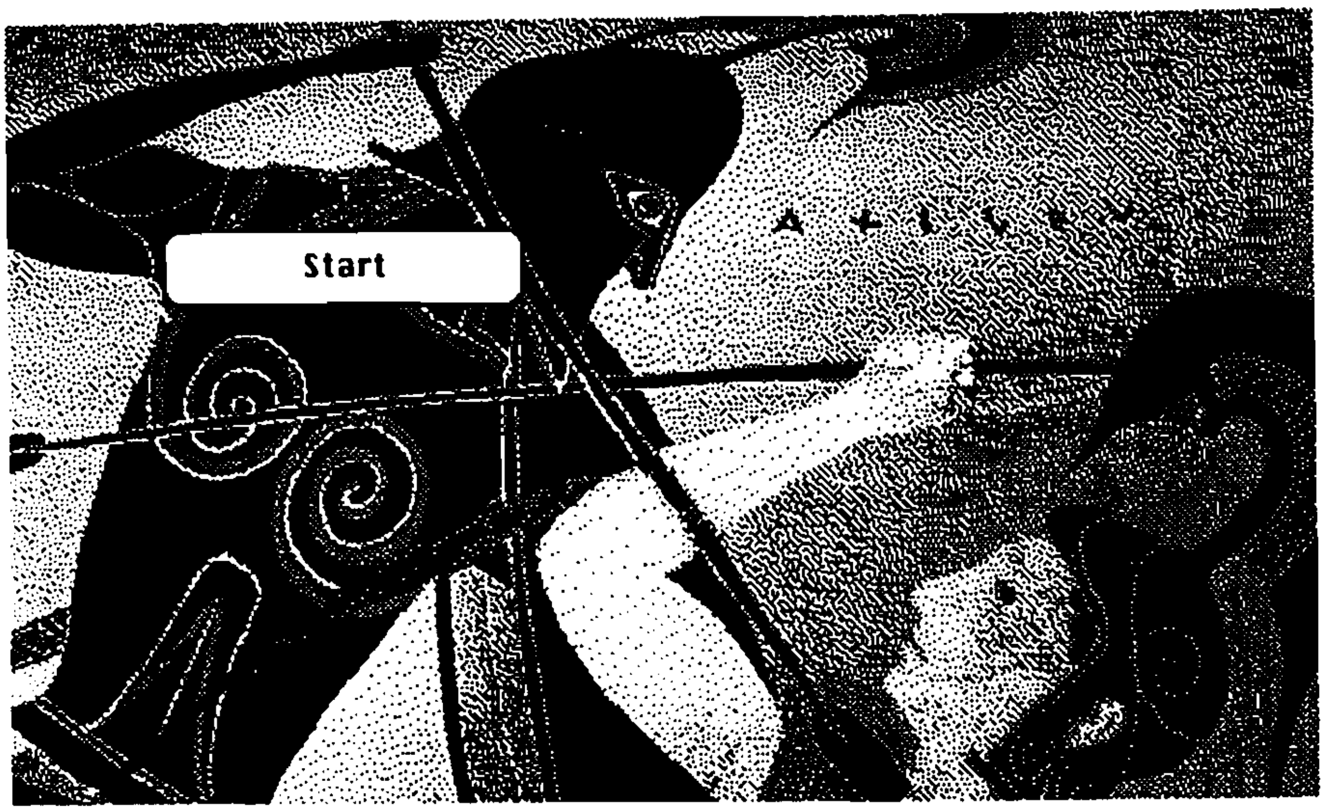


goals, working styles, and responsibilities, also seemed to build richer networks of hypotheses. 3. Use of supplementary resources. Inference-building happened most frequently at some remove from the computer, around print-outs, maps, timelines, videodiscs or books that helped children locate a perspective outside of the "site" from which to consider the meaning of its contents. Site maps and portfolios of artifact print-outs were especially useful "spaces" in which children could gather and compare information from their research and speculate about the meaning of their find. Groups in which children did sustained work research with other resources tended to make more inferences, and also to integrate more background knowledge into their interpretations.

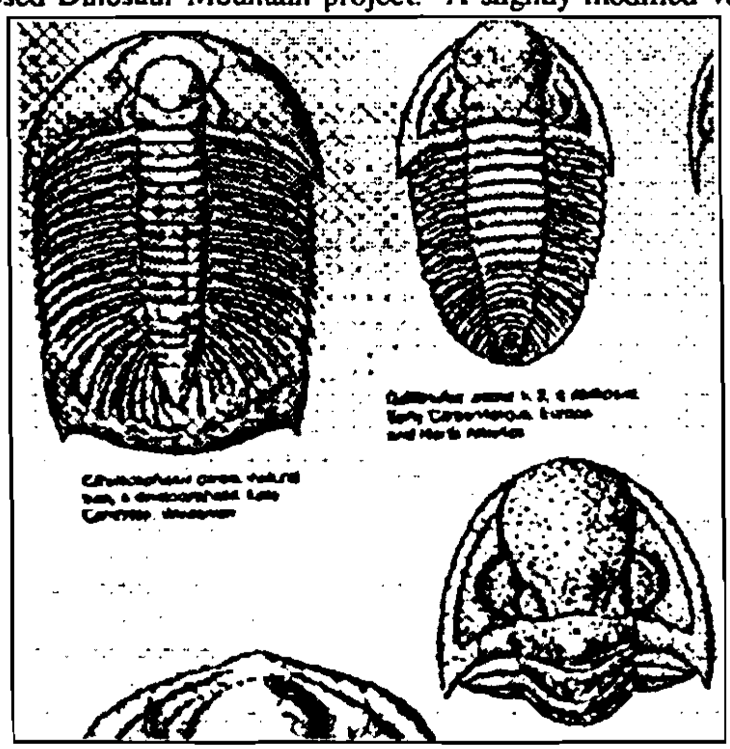
Science

Ecotype -- Dinosaur Canyon: A scientific expedition from the classroom:

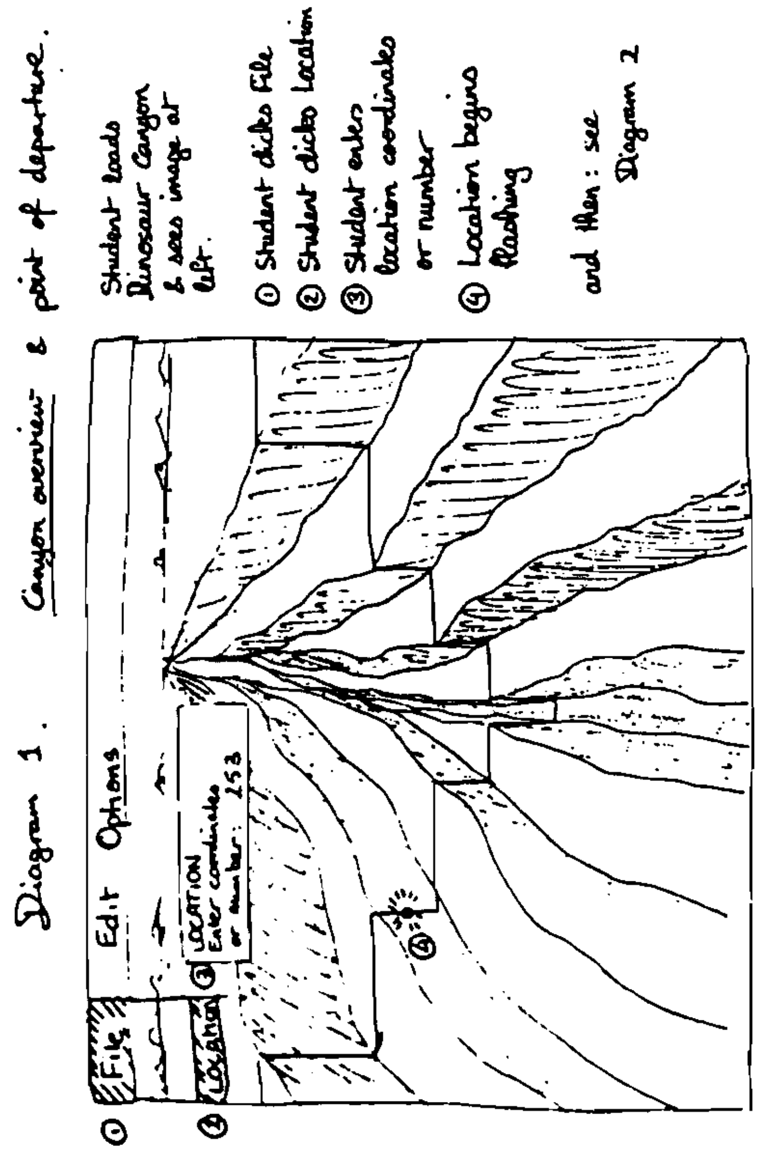
Malcolm Fenton
  Science Teacher, Middle School and High School
Rachel Bellamy
  NLTL Software Engineer

The Dalton tradition is one of open-ended, interactive learning that addresses the needs and potential of the whole child. This project is designed to help apply this educational philosophy to the teaching of the natural sciences. Funding is sought from the Tishman Grant to develop a prototype computer program called *Dinosaur Canyon*, for initial use and testing in the classroom in the spring of 1993.

Dinosaur Canyon is a prototype version of the previously proposed Dinosaur Mountain project. A slightly modified version



of that earlier proposal is attached, and the pedagogical reasons driving this project are outlined therein. The present proposal deals exclusively with the *Dinosaur Canyon* prototype. The wider



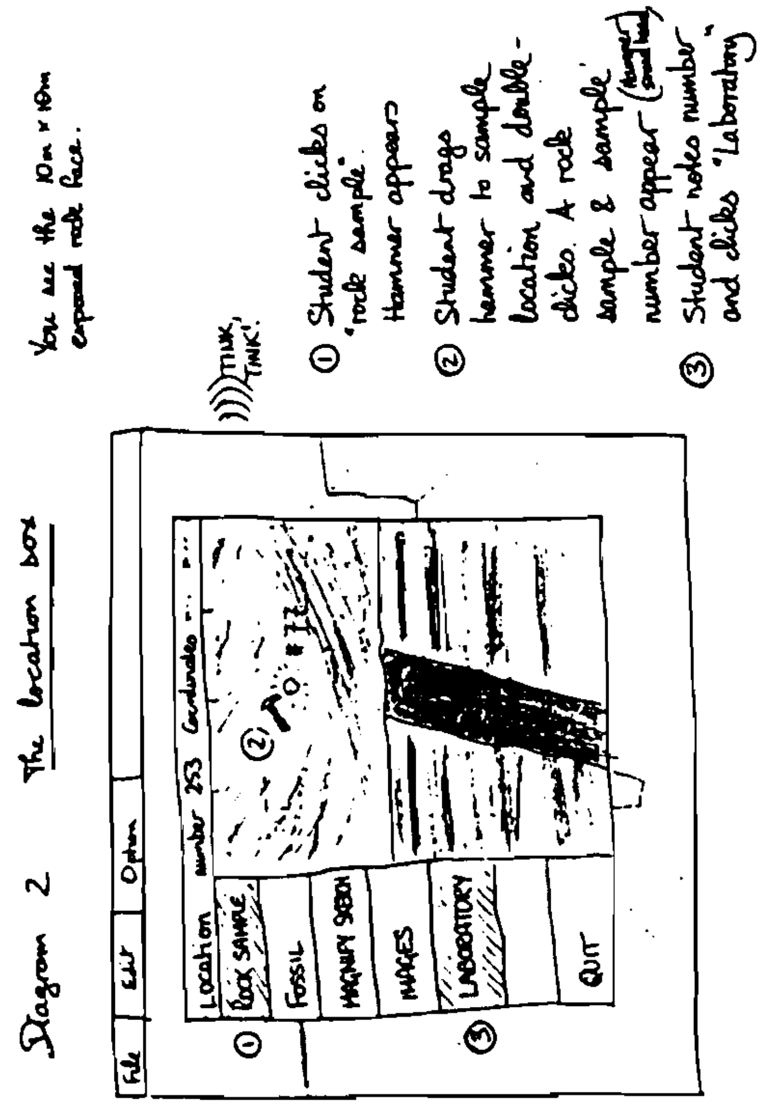
goals and purpose of the main project are retained. *Dinosaur Canyon* can later be extended to meet these goals. In this initial prototype, however, the scope of the subject matter and the complexity of the program have been reduced. In particular, the topography of *Dinosaur Canyon* is simpler, and this prototype only contains geological and paleontological data.

Four principles underlie the design of *Dinosaur Canyon*. The program is simple in its underlying structure, to facilitate development within a ten-month period. The design is modular, allowing expansion and refinement at any stage of development. *Dinosaur Canyon* has integrity it is designed to stand by itself as a teaching tool, and not be a partially developed fragment of a larger program. Lastly, accessibility and ease of use by students is of paramount importance. With this in mind, an intuitive, point-and-click mode of operation has been chosen.

PROGRAM STRUCTURE

Dinosaur Canyon consists of a profile of a canyon (see diagram I). There are approximately 200 locations along this profile. Each location is a 10 meter by 10 meter square surface, either horizontal or vertical. The topography of many canyons is dominated by verticals and horizontals, rather than sloping terrain. (The Grand Canyon is a striking example, and in fact a primary inspiration for this project.) The terrain of *Dinosaur Canyon* was chosen to simplify the design and programming, and to make the understanding of spatial relationships easier for the student. Most strata are horizontal, so that vertical locations show slices through time, and horizontal locations show extensive views of paleoenvironments.

Each location contains a wealth of geological and paleontological data (diagram 2). First there is the colored geological sketch of the rock surface itself, showing the extent and structure of the rocks. Using a hammer icon, the student obtains the number of a rock sample. This number corresponds with a real rock sample in the classroom, which the student can then examine and identify. The student can also take the sample to the computer laboratory (diagram 3). There she can obtain radioactive dates, geochemical data and microscope enlargements of thin sections of the sample. The student may also extract fossils from locations and take these to the computer laboratory for examination. The use of realistic and appropriate icons, sounds and backgrounds will add life to these and other functions.



The program and pedagogy are designed so that the students will be using the approach, methodology and the analytical skills of research scientists. The program is the source of data -- the student selects and extracts evidence from the locations along the canyon profile, and sends the samples for analysis to the computer laboratory. All data and ideas are recorded by the student in her research notebook. The geological sketches are recorded on graph paper, and are later used to produce maps and timelines for the canyon s geological history. The interpretation of the data is achieved through mathematical analyses, graphing, building geological and fossil successions, and through discussions with neighbors, groups, and ultimately with the entire research team. Reference materials -- books, videos and data bases will be available in the classroom and will be used extensively for research. The computer program will contain a bibliography to guide students to these other resources.

Middle School students are the intended users of this first prototype, -- perhaps sixth graders, who follow a methodology closely allied to the one outlined above when they use the Investigation-Colloquium Method in science class. (The program can be extended later for High School use.) A sample assignment addressed to sixth graders is attached, and serves in lieu of a scenario in this proposal. A full scenario for Middle Schoolers is given in the original Dinosaur Mountain proposal.

COMPELLING QUESTIONS

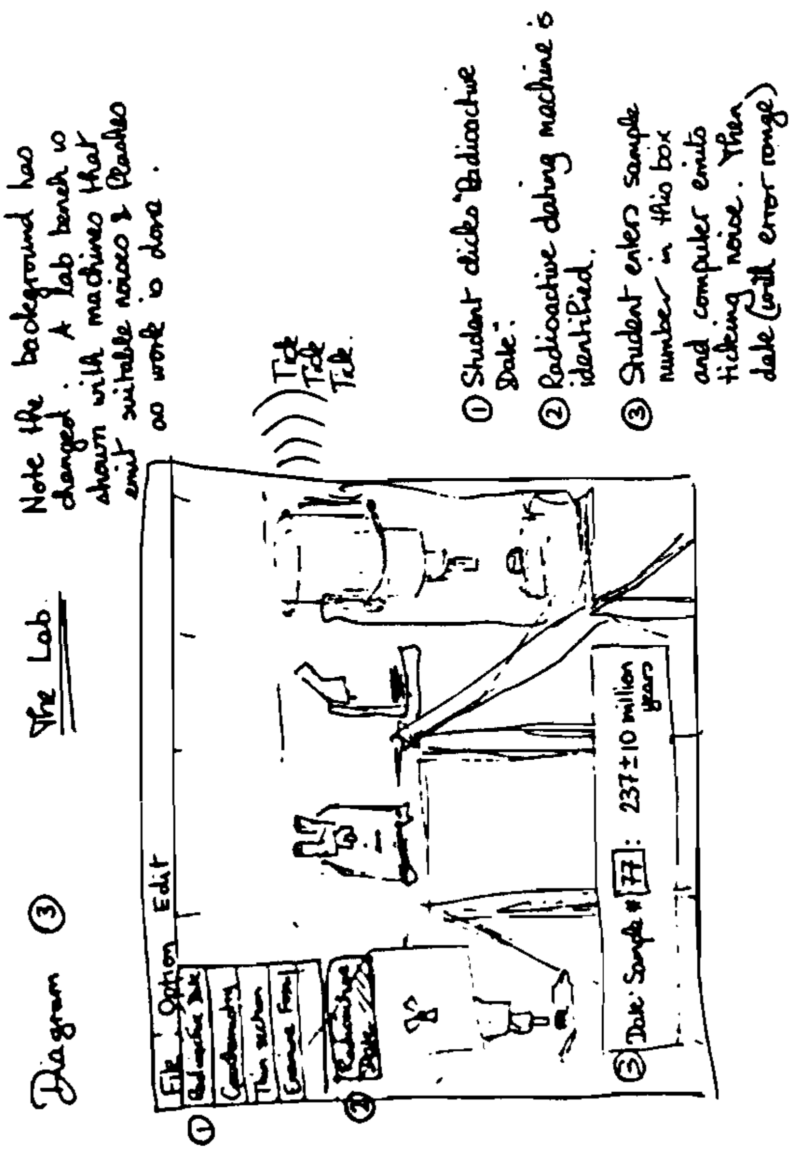
What is it that will motivate students to plunge into *Dinosaur Canyon* and engage in inquiry? In the attached assignment, students are asked to first examine a paleoenvironment, then a geological succession, and then to create their own geological succession. The compelling questions arise naturally from the tasks, and can be summarized as follows:

(a) Paleoenvironments: What was this area like at this time? Build a picture of the environment -- describe, draw, make models of it. Imagine that you stay there for a day.

(b) Geological successions What was the story of this area? Imagine the area changing over millions of years before your eyes -- like a speeded up movie. What happened? Why?

(c) Build your own succession: Can you use your imagination and what you have learned to build a geological history of your own?

The function of the teacher is to help the students to ask useful questions, and to provide structure and guidance. Once the inquiry is under way, it will have its own momentum.



EVALUATION

The project will be extensively evaluated by teachers, educational consultants, the designers and the students. Students will be observed, tested and questioned before, during and after the *Dinosaur Canyon* unit. The following measures will be included:

- objective tests of students skills and knowledge
- evaluation of students learning styles and their progress
- student evaluation through questionnaires.

A presentation and summary report will be given at the end of the testing of *Dinosaur Canyon*.

SCHEDULE: June 1992-June 1993.

The following schedule assumes two core developers working together – Malcolm Fenton and Rachel Bellamy. Our collaboration has already proven most fruitful in the development of ideas and approaches, and is one that we view as a fundamental strength in the making of *Dinosaur Canyon* It is further assumed that Malcolm Fenton have a one month additional contract for June 12-July 12, and be relieved of 1/5-2/5 of his teaching load next academic year, and that Rachel Bellamy will be allowed to devote 50%- 75% of her time to this project for the period June 92 to June 93.

Constraints of time will be the primary determinant of how detailed and polished *Dinosaur Canyon* will be by the time of testing next spring. We recognize that our other duties within Dalton place these time constraints upon us. Accordingly, we propose that another person be employed as a part-time assistant to accomplish time-consuming tasks that do not demand our special skills. The scanning-in of images and the entering of other data into the computer would figure prominently here. A reliable postgraduate student familiar with the technology would be able to fulfill these duties.

The schedule below also assumes that there will be ready and continuous access to the following equipment: a scanner, a CD-ROM, two IBM machines (one for Rachel, one for Malcolm) and a Mac IIci (to be shared by both developers). If purchase of some of these items is required, then the budget estimates will rise accordingly.

The following schedule has been divided into two parts, each listing the principal individual responsibilities of the two designers over time.

Malcolm Fenton

1992

June 12-July 12:	Basic scientific framework and pedagogy. Basic geological structure and sequence. Preparation of 2 horizontal and 2 vertical locations. Gathering of references and other materials.
July 12-Sept. 4:	Vacation, with possible collection of some samples and images.
Sept.-Dec.:	Design of 100 vertical and 80 horizontal locations. Co-supervision of insertion of locations into program. Continued gathering of reference materials.
Winter vacation:	Field trip to the Grand Canyon area to gather samples and images.

1993

Jan.-March:	Design and insertion of additional locations. Pre-testing and refinement of program. Design of evaluation.
April-June:	Testing in the classroom. Presentation and summary report.

Rachel Bellamy

1992

June-Aug.:	Basic structure of program. Initial programming for locations and data, and development of tools to allow others to add data, graphics etc.
Sept.-Dec.:	Programming for locations and data. Observations of students and preliminary formative evaluation. Co-supervision of insertion of data into program.

1993

Jan.-March:	Pre-testing of prototype.

Design of evaluation of software.
Programming of data-gathering tools.

April-June: Testing in the classroom.
Presentation and summary report.

* * *

The High School

Science

Project Galileo: A Proposal for Using Computers in the Study of Astronomy:

Malcolm H. Thompson
Teacher, High School Science

I) PROJECT NARRATIVE

Project Purpose

This work is inspired by the original philosophy of Helen Parkhurst's Dalton Plan, from the conviction of the New Laboratory for Teaching and Learning that the new technology can allow the Plan to be reimplemented, and from the informed methodology of the New Science Literacy Project. The combination of these factors determines the nature of the products envisioned by *Project Galileo* -- a resource laden science environment in which students, under the guidance of teachers, are encouraged to invest their energies in the creative activity of genuine scientific inquiry. Success in creating such an environment will produce a model for teaching science as compelling as the *Archaeotype* model in social studies and so may initiate substantial change in science education in general.

Origin

The project was conceived out of a growing dissatisfaction, extending over the course of a 25 year teaching career, with conventional astronomy courses, however well taught. The traditional format simply did not provide students with a continuous, experiential encounter with the primary objects of inquiry -- the images and data from telescopes and associated analytical devices. In the past ten years, as these materials have become digitized for mass use via computers, new possibilities have slowly become apparent. Vast libraries of these materials are now available. During a December 1990 visit to the Hubble Science Institute, the Project Manager had an opportunity to view a digitized all sky image survey. That was the defining moment. It triggered a determination to bring such resources to the classroom and to develop meaningful educational activities around them.

Search

Search procedures have fallen into three basic categories. Astronomy texts, professional and popular articles on astronomy teaching, and articles dealing with technology-based educational innovation in physics and astronomy. Much of this research has been conducted over the last 25 years as a matter of course through the Project Manager's participation in the business of astronomy textbook writing and revising and in the community of authors in the field. Research into image and data availability began much more recently, in the spring 1991, and is being undertaken through continuous contact with colleagues in the field (See item on Professional Network). Computer application programs search began in the summer of 1991 and was also conducted through that network of contacts, through New Lab personnel, and through journals. About six programs of the Voyager type exist. All do about the same thing. All but Voyager run on IBM. During the spring of 1992, the most promising of these will be tested by students and by the Project Manager.

Only two suitable astrophysical type programs have been identified by research of the professional and educational colleagues, and in the literature.

1) the Pynzinsky Stellar Structure Simulation -- Extant but not yet located.
2) Toomre Galactic Collision program which is currently on order.

No reference to any teaching programs of specific astronomical concepts have been found. This particular area is where intensive project programming is needed. Specifically:

1) Celestial Sphere Orientation -- mostly graphics .
2) Spectra acquisition and analysis. This is a big job.
3) Distance determination beyond Parallax
4) Photometric Studies
5) H-R plots and Stellar Radius determination
6) Mass -- simulated or real binary studies.
7) Astrophysical equation framework use programs (about 14

interlocking equations).

Technology Focus

The nature of the subject depends upon the new technology a-priori. The images employed in virtually every activity, those already carried out and those projected, are digitized. The simulations (for example, Voyager) are computerized and the vast data bases (for example, NGC catalog) are most effectively manipulated by electronic means. Photographic and print materials (Palomar survey plates, star atlas), as well as basic instruments like the calculator and telescope, play a vital part in the activities of *Project Galileo*. But their use is always integrated into the larger context of exploratory activity grounded in the new technology.

Unique Problems

Unique problems for this project exist in two areas. First and foremost is the fact that it is being developed on-line with 37 students committed to the project under conditions which are only beginning to be congenial to the new concepts of pedagogy. That fundamental circumstance underlies a continuous and immediate need for resources of all kinds. Every week without adequate support is an opportunity lost. A second unique problem area involves the opportunity to import "live" images from existing research instruments such as Mt. Wilson and NOAA. An adequate communications system and the associated imaging software and expertise are required to realize this possibility.

Relationship to Whole

Computer networking is beyond the ken of the project author. Anything that would enhance the accessibility of computer-based resources is obviously desirable, but, beyond that, it is not clear at the moment how *Project Galileo* relates to the whole from the technology standpoint. Student management and tracking benefits would accrue from a networked environment. From the content point of view, certain connections to other science disciplines and to mathematics are inherent in the subject and one can easily imagine a convergence of *Project Galileo* with computer-based physics and geometry courses, for example. Connections to the humanities are more difficult to envision -- certain obvious possibilities on the horizon (Copernican theory and the Renaissance etc.) would need systematic consideration. But *Project Galileo* attempts first to create an easily accessible, complete, and realistic astronomy landscape and then turn attention to the creating of portals and links to the humanities. The majority of the student clientele, locally and nationally, are resistant to the integration of science with the rest of human knowledge. At the core of the resistance is the belief that the subject is inaccessible. *Project Galileo*'s first goal is to eliminate that belief.

Professional Network

The professional network grows over time. The following lists affiliations to date:

Formal Collaboration

1) Mount Wilson Institute -- verbal agreement has been reached with the Mount Wilson Institute Director for collaboration (mostly on "live" images) with the New Lab on *Project Galileo*. Also a joint NSF grant proposal is being discussed and a teacher workshop in Summer 1992 is in the planning phase. Contact: Robert Jastrow, Chairman, Mt. Wilson Institute
2) Center for Astrophysics, Harvard Smithsonian Astrophysical Observatory Contact: Sallie Baliunas, astronomer.
3) NASA -- Contact: Jeff Bennet, grant officer
4) NOAA, Colorado. Arrangements have been made to tap into their computer to extract daily solar images from seven observatories. Contact: Dave Spike, solar astronomer.

Links in the Making

1) Hubble Science Institute, Baltimore, Md. -- Vicky Laidler, Douglas Duncan.
2) National Solar Observatory, Sunspot, NM -- Dave Brown, photographer.
3) NASA, JPL, Pasadena, California -- Jastrow is working on JPL

4) Yerks Observatory, U. of Wisconsin -- Michael Drieser

Additional Funding

The project has also applied for a supplemental grant from NASA, is considering a proposal for NSF, and is actively seeking foundation, corporate and private support.

Dissemination

Within Dalton: no conventional wisdom yet exists on the appropriate grade level for use of these new resources within *Project Galileo* but aspects of the resources should be useful at all levels, k-12 and beyond. This is consistent with the "when they are ready, provide the means for them to inquire" philosophy of the New Laboratory.

In the primary development site, the high school astronomy course, each resource will be developed as a self contained exploratory module to be sequenced, networked or matrixed with the other resources. Ultimately, (1992-1993) the matrix will form many alternative pathways of inquiry or can be retained as a course of study. Each self contained exploratory module or part thereof can be "tipped" into existing science courses and/or used as small independent study modules for students with the rest of the matrix available for wider exploration. At all points in the project, connections to other disciplines will be actively sought and pathways established.

For the secondary development site, a packet of modules will be assembled as a series of historical and intellectual stepping stones from Newton to Modern Theory for the NSL eighth grade course. While solving the NSL problem the program in larger movable units can be tested. This plan is the fundamental connection between *Project Galileo* and the New Science Literary Project. It has the positive value of exposing three science teachers (Grossman, Lai, Novakovic) to the experience of new technology-based, exploratory science course teaching and provides additional testing of materials.

As part of tertiary development, computers with limited access to resources will be available to all middle and high school students with opportunities for free exploration of them on an independent study basis. As with the course, pathways of inquiry will be monitored and subsequently facilitated. As part of this latter effort we will be experimenting with various ways to keep the resources available to all students on one computer with limited interactive capability while potential heavy users are shunted off to other, fully interactive computers on which they may spend long hours. All students in the astronomy class will work with fully interactive computer software. Three high school students have "come out of the woodwork" to work in astronomy this summer.

Brief astronomy units are taught at the second and fourth grade levels at Dalton and coordination with the teachers of these courses has already begun. They have agreed to scheduling their astronomy units for the spring term in order to allow for further development of the project and for their familiarization with the activities. Negotiations have begun with the sixth-grade users of I-CM to include some astronomy activities in that program. Also plans have been made to create a pathway from the *Archaeotype* project to the *Galileo* project for sixth-grade participants.

External dissemination: Teacher workshops, NSTA conferences, courses in teacher training institutions. Specific plans have been withheld until a refined and compelling set of materials are in hand; or at least until the precise nature of the product and its capability is known. From experience in fall 1991, a clearer picture of the product is emerging and the refinement process to fruition identified. Dissemination will begin with a series of articles, see Documentation and Publication. The Josie Dean tape collection should be analyzed to see if a short documentary suitable for publication can be assembled with existing stock, perhaps supplemented by some interviews with students and on Palomar Plate activity.

Documentation and Publication

Articles for educational journals (*Science Teacher*) and popular astronomy magazines (*Sky and Telescope, Mercury, Astronomy*). Jastrow and Thompson will publish a revision of their text book which will integrate lessons learned from the new technology and

Project Galileo products.

The following are potential articles, titles and subtitles as contributions which could be made to the literature from *Project Galileo* over the next few years. The subjects range from specific classroom activities (1-5) to general curricular and teaching matters (6-7), to larger issues or entities of a national nature addressed to educators in science and other disciplines.

1) All Sky Computer Programs: The New Technology Based (NTB) classroom as a tool for teaching conventional astronomy.
2) Voyager in the NTB classroom as a research object and as a research tool.
3) The Palomar Plates: A "real " sky activity using computer and print based reference material in an independent study.
4) The Palomar Plates: Constructing a research tool to enter the astrophysical equation framework.
5) Using a Student Constructed Research Tool: Investigating the astrophysics of open clusters, globular clusters elliptical and spiral galaxies.
6) Double loop learning: A model for change in a teacher-student collegial atmosphere.
7) Education under The Dalton Plan Revisited: The New Technology provides the means for independent work in the classrooms of the future.
8) Scientist-Teacher-Classroom: A model for rewarding interaction.
9) Astronomy Educational Resource Data Base: A book in a Multimedia Library.
10) Reenactment of the crucial Historical Experiments: The means are at hand.
11) A Model For A New Kind of Text: Wedding the interests of software producers, publishers, schools, other educational institutions and governmental agencies.
12) Uniting diverse resources in a national School Project: The High School Astronomical Catalog. A reason for a

Network.

13) A Good Product and a Good Stipend: The essential tools of change within the school.

14) Funding Change in the Schools: A new consortium of National and Local Foundations.

Student Assessment Models/Issues

The Project Manager has always made heavy use of continuos labs with students. Discussions are pegged to entries in the "Book of Life," to which students are asked to respond to in the same way they respond to and evaluate their own reports as they are being written. Explicative summaries of leading ideas have also been a feature of the astronomy course for a long time. Student assessment in the context of *Project Galileo* will build on the same principles, while taking specific advantage of opportunities afforded by the Project.

The cardinal points of difference afforded by the *Galileo* context are these:

1) students do most of their work in company with other students and the teacher.
2) students are collaborating in realistic research .

In these circumstances, errors or intentional deceptions can cause other peoples' work to suffer, while careful, honest work can actually impact the science itself. We have already had a case in which a student has apparently detected a galactic object on a Palomar Plate which is misrepresented in the official catalogue. In another instance, a student who had evidently done some hasty and inaccurate work on his plate had to request evening time to "go over my numbers" when it became apparent that another team of students was about to use his results. For essentially the same reason, students have had to learn the difference between executing a packaged "research" activity and designing a research activity they might have actually to carry out. In that latter case, the student's own activity becomes an assessment of his or her plan. As soon as the technology and programming allow, student portfolio construction will begin in earnest, and it will then be possible to formalize such important additional assessment indicators as time logged on-line, applications employed, avenues explored etc. All of these experiences take place in the context of ongoing discussion, not only of student performance, but of *Project Galileo* itself. Assessment therefore overlaps with Evaluation (See next item).

In a nutshell, *Project Galileo* is responding to opportunities for new modes of assessment as the activities unfold in practice. At the same time, more traditional standards of evaluation -- midterm exams, problem sets etc. -- are still being employed and may serve as a convincing assessment supplement.

Evaluation

Thomas de Zengotita has played the role of participant-observer in the course from the beginning. He is keeping a record, not only of his own suggestions, but of written student evaluations which are collected at the beginning and the end of each activity undertaken by *Project Galileo*. The plan is to systematically employ these, and all other evaluative resources, in an effort to integrate the components of the *Project Galileo* with respect to the networked system and to project the activities of 1992-93 on that basis. Consultations on evaluation mechanisms are planned with the Multimedia Library and with the Bank Street team. If outside evaluators are considered appropriate, and if they are to be of real value, they should begin to acquaint themselves with the process of the course as soon as possible.

The most striking and encouraging evaluation opportunity opened up quite unexpectedly at the initiative of a group of students who signed up to be on a Course Evaluation committee which meets after school every other week. Other options were Astro T-shirt, Telescope, and Daltonian Astro-Column Committees. It is a measure of the depth of student commitment to *Project Galileo* that more students signed up to evaluate than signed up for the other three committees -- for this committee is not sitting around making casual suggestions, but is committed to breaking down each activity in detail and proposing concrete changes in sequencing, preparation, wording of instructions etc. And this in a context in which students unanimously report that they do more work in this than in any other course they have ever taken. The level of what one student called "Astro-bonding" is extraordinary and offers an exceptional opportunity to realize the original idea of a laboratory in relation to course evaluation.

II) PROJECT GOALS

While the project is a three year one, "goals" in this document will primarily address the first year. The overall goal of the first year of *Project Galileo* is to acquire or assemble technology-based resources and to create, test, and refine strategies for their use in the high school astronomy class. The overall goal will be realized as a series of exploration modules following the current topic sequence and specified in the next section on Program Implementation. The modular approach allows for serious testing of particular resources and strategies while providing for the possibility that certain elements of the course may fail more or less completely (for example, group approach to problem solving). The modular approach allows the. Project as a whole to proceed and even to benefit in the context of occasional failure.

By the same token, but on the positive side, an important aspect of the modular design of the Project allows attention to follow natural pathways of inquiry which students spontaneously take when in control of the resources. A serious sensitivity to student innovations calls for a careful balance between the requirements of planning and control, on the one hand, and a willingness to "stay alive" to unanticipated opportunities. Student initiated pathways which succeed will be expanded and institutionalized in revised versions of the Project in the future. Procedures for continued expansion and revision will then be built into later versions of the project and so on, within the concept of the Cumulative Curriculum.

The final goal of the first year of *Project Galileo* becomes to reflect systematically on each of the modules and all the evaluative feedback accumulated over the course of the year. The summer becomes a time for systematic reflection and projection the emphasis of the summer will be upon integration of the modules - from the point of view of the course, to begin with, but also from the point of view of the networked multimedia system as a whole. That will also be the time for reopening questions about cross-curricular linkages and so on.

A packet of modules will also be tested in the eighth grade science course and transitional activities created. These modules will become available for free use by students at other levels in the Dalton School .

III) PROGRAM IMPLEMENTATION

Experience to November 1991 shows that the best implementation strategy will be tailored to this Project's unique development scenario -- that is, its class-based trajectory. The most efficient and fruitful pathway is to identify a resource (The Voyager, The Palomar Survey Plates) create a pedagogical goal using the resource, then convert that goal into an explicit task for the students -- in short, a module. The task is then executed by students with the teacher at hand to work along with them, filling unanticipated gaps in the instructions until they successfully complete the task. Then a post-mortem is conducted as described under "Evaluation" above. Then the process begins again until the final, year-inclusive loop is traversed over the summer of 1992. Implementation objectives for *Project Galileo* are defined in accordance with that strategy.

Key elements in the success of this strategy are the high quality of the resources, the wise selection of the task, the commitment of the teacher to work through the task with every student to successful completion, the sense of responsibility, ownership and engagement in a larger arena by the students, the candid assessment outlet of de Zengotita which leads to a collegial atmosphere, and the ability of the project personnel to react to, extend and exploit student reactions to the materials in a timely way.

The Modular Approach breaks down abstractly, in the following way:

1) Introduction
2) Day by day teaching plan
3) Technology familiarization exercises

4) Background, historical, scientific, guideline text material
5) Group problems and questions requiring use of the resource
6) A summarizing experience

From an operational standpoint, still in the abstract, the creation and implementation of a module reduces to a sequential set of tasks. The general task stream is as follows:

1) Identify the resource.
2) Determine its availability.
3) Make a cost-benefit, time scale evaluation of the resource Possible outcomes of the evaluation.
   A) Useful and available immediately.
   B) Useful and available in the future (possible alternatives for development).
   C) Not useful or not available (must create).
4) Acquire or create resource.
5) Design exploratory pedagogy for resource and identify technology requirements.
6) Draft pedagogical materials.
7) Initiate resource presentation programming, communications link, interactive programming, link to other resources, etc.
8) Unite pedagogy, computer, and other required media for presentation, making revisions as necessary.
9) Use resource in student setting, monitoring student input and evaluating effectiveness.
10) Revise presentation -- pedagogy, programming, acquisition of more resources -- for first dissemination version.

The Modules planned for *Project Galileo* in 1991-92 with approximate dates for their initiation and completion are given below. Complete descriptions of the modules correspond to the actual assignments distributed to the class. It is important to remember that the modular strategy allows room for maneuver -- so, for example, because programmer resources needed to create the Observatory were not available, the Blue/Red Plate magnitude temperature module was undertaken instead:

Module #1	Voyager -- Naked Eye Classical Astronomy Sept. Oct.
Module #2	Palomar Plate Object Identification -- November
Module #3	Palomar Plate Red/Blue Magnitude and Temperature. Tool Building and Testing -- December.
Module #4	Observatory Program The equation framework of astrophysics; Spectra, Mass and the Observational base; Stellar evolution. The sun as a star. -- January.
Module #5	Palomar Plate Galaxy Analysis; The Red Shift and cosmology -- Feb., March.
Module #6	The solar system. The Planets, the Earth -- April.
Module #7	The Origin and Evolution of Life. Intelligent life in the Universe -- May.

More tangible implementation goals, some bearing on particular modules, some on the Project as a whole, are listed below under Content Objectives.

1) Student Achievement Objectives:

The inventory of computer skills so far, and astronomical skills are explicit and have been or are being mastered by all the students.

Additional explicit computer and astronomy skills for successive modules depend upon the exact nature of the modules which in turn depends upon resource availability and the exact pedagogy of presentation. The general skill list is implicit and while all have had one or two experiences in which developing skill in these areas was required, only a handful have internalized them. Development of skill in these areas will be an ongoing process informing the nature of the activities in successive units.

Computer Skills so far:

1) Word Processing

2) Use of Voyager 1.2 (All Menus)
3) Image Scanning and saving -- Adobe
4) Data Base Searching -- Filemaker
5) Image Analysis Techniques -- Image 1.26
   Grayscale Plot
   Inverting and Magnifying
   Threshholding
   Magic Wand Measurements
6) Use of the Apple Menu Calculators (normal, dCAD)
7) Use of Menus and Windows
   Floppy, Hard Disk, Opening and Saving Files, Printer

General Non-Computer Skills so far:

1) Graphing, graph interpretation
2) Mathematics- arithmetic, logs, Scientific Notation
3) Planning activities in sequence -- defining the product objective
4) Time Budgeting -- avoiding task postponed to deadline.
5) Expository Writing
6) Small group task completion
7) Integrating Diverse Resources, Media
8) Problem Solving
9) Intellectual honesty as a peer-driven value
10) Equation description, real-world relationship

Astronomical Skill so far:

1) Identifying constellations (star, planet) in sky
2) Determining if object is observable and where to look
3) Use of RA, Dec Coordinate System
4) Use of Altazimuth information for observers
5) Use of Star Atlas
6) Use of NGC Catalog
7) Use of Palomar Plate catalog
8) Use of Messier, Splendors, other References

9) Palomar Survey Rigorous Object Identification
10) Palomar Survey Plate (B R). Magnitude and Temperature determination
11) Ability to "eyeball" a plate to recognize Stars, Globular, Clusters, Open Clusters, Galaxies, Nebulas.
12) Ability to look at red and blue plates to very roughly estimate the magnitude and temperature of stars
13) Theoretical application of the Plank radiation curve distribution.

The astronomical skill list, a list of behaviors, naturally overlaps the content area. But the content area objectives are defined in terms of the New Science Literacy outlook which views science courses for humanities students (as most of the students are) as a means for developing a merged system of thinking which combines the intuitive with the formal -- the crucial criterion of scientific literary. It is only when that system is in place that the content of any branch of science can be appreciated and understood in the deepest sense. When that level of appreciation and understanding is achieved the elegant simplicity, the unity and power of a few basic first principles, the constraints and opportunities inherent in the scientific interpretation of the physical universe, enter the active thought processes of the student.

2) Content Objectives

Module 1 -- Classical Observational Astronomy.

Experiences merging a numerically based formal system with intuitive observations. What you see depends upon what you know. The Voyager program itself provides an example of the power of a formal system to inform intuitive inputs.

Evaluation criteria: complete knowledge of the celestial sphere, its formal coordinate system, understanding of the connection between observable phenomena from earth and the actual motions of objects as seen from a point in space. The lingo of classical astronomy.

Module 2 -- "Classical" Telescopic Astronomy and the contents of the Universe.

Entry into the discipline. Experience transferring the focus of inquiry from the "real objects" to the output artifacts of instrumentation using professional level materials. Voyager, Palomar Plates, NGC and messier Catalogs, and schematic and image atlases with a common thread of identity provide an example of the unity of science. Introduction of the hierarchy of structure and the three basic forces. Success connotes accessibility to the discipline and confers entitlement to the novice.

Evaluation criteria : flawless recognition of plate images and how to identify them. The smearing of the boundary between the objects and the images.

Module 3 -- The Basis of Modern Astrophysics.

Experience translating images to numerical data via measurement with arbitrary units then translating them to standard units by statistically establishing the relationship between the two with a whole class data set. It's not what they look like it's the numbers they yield up. This is the essential experiential step into the equation framework of astrophysics.

Evaluation criteria: Complete knowledge of the physics, math, and translation of image size and brightness on the plate to magnitude and temperature in the framework.

Module 4 -- Stellar Evolution.

Experience building up an equation framework from observation (Distance, Luminosity, Composition, Mass) and theory (thermodynamics, nuclear physics, gravity, radiation, equilibrium) and the formulation of a complete scientific theory -- stellar evolution.

Evaluation Criteria: Complete knowledge of the physics and techniques of measurement of stellar characteristics, the H-R diagram and the life story of a star.

Module 5 -- Application of the Complete Theory.

Experience in the application of the cumulative, hierarchical knowledge in science. The outcome of stellar evolution theory becomes the means of interpreting the measurements of temperatures and of motions of galaxies and star clusters in order to understand their origins and histories. The confluence of philosophy, religion and science in the subject of cosmology.

Evaluation criteria: complete knowledge of the connections between stars and galaxies and the quantitative base of scientific cosmology, interpretation of the evidence as theories of cosmology.

Modules 6&7 -- The Solar System and Planets, the Earth, and Life.

These Modules have not yet been designed, but the thrust of the science will be exposure of the complexities of planetary, geological, and life sciences, all of which lack an equation framework. Nonetheless, all are logically and physically constrained by fundamental principles which are buried in the rigorous framework.

3) Hardware and Space Objectives:

A) A small space with a door, a table to work on and a computer/secretarial station, accessible to students is desperately needed for me to complete the writing, etc. for this project.

B) There is a general project need for an astronomy/science computing facility room. Room 307 is the most near ideal. Current scheduling is such that moving one history class will make the room' available for 25 hours/wk (12 scheduled astronomy), but nine of the 15 periods of unavailability are eighth grade classes in which we intend to introduce computer use in the spring. The 100 eighth grade students will completely overwhelm the current library facilities. Some renovation and refurbishing is required.

4) Software resource Objectives

A) "Buys"

1) Existing
   Voyager 1.2 Carima (in house)
   2 equivalent IBM
   Dance of the Planets (on order)
   Lodestar II. Zephyr (on order)
2) Scanning software (in house)
3) Image 1.26. Adobe Photoshop (in house)

4) Filemaker Pro (in house)
5) Sky publishing 3000 NGC images (on order)
6) Stellar Interiors Software (Paztnski program -- Trying to locate)
7) Compuscope (near completion)
8) Galactic Crash -- Zephyr on order
9) NGC data base -- spread sheet graphing
10) Stellar data base -- Sky Publishing
11) Other Imaging Software if available
12) Communications Software
13) Plate tectonics Software U of Texas (trying to locate through Rampino)
14) JPL Voyager Spacecraft images (CD-ROM in house)
15) HyperCard, SuperCard (in house)
16) Class management Software -- network. Exists? Search? Write?
17) Gravity Program (in house)

B) "Builds"

1) Observatory program (spectra, etc.).
2) Equation Framework program.
3) Celestial Sphere teaching program.
4) Messier object background program.
5) Cumulative Astro catalog program.
6) Programs linking resources.
7) Galactic Red Shift program (Possibly U of Maryland IBM).
8) Spectral teaching Program.
9) Biology -- origin of life program (possible adaptation of (Nbody program).
10) Programs relating to inter-school networking.
11) Stellar Mass measurement programs.
12) HR diagram 3 dimensional plotting program.

13) Galactic Hidden Mass Program (Possibly U of M IBM).

14) Spectral line analysis program.

5) Time Objectives:

De Zengotita has long insisted that serious pedagogical reform at the classroom level will depend upon overcoming the "tyranny of the schedule." Due in large measure to the overwhelming number of students who insisted that success in the Palomar Plate activity depended above all on their working in extended blocs of time, the Project Manager now shares de Zengotita's conviction. Preliminary conversations with various department heads in the High School have already taken place, and a surprising flexibility is evident. Verbal agreement to a serious discussion of schemes for reworking the high school schedule to allow for 3 hour periods during one week in February has already been secured.

IV) MILESTONES

The charting of milestones depends upon the operationalizing Project Goals through Program Implementation (III and IV above). It makes sense, therefore, to settle upon those objectives before actually executing the Milestone chart.

V) BUDGET NARRATIVE AND SUMMARY

I will need some guidance in order to distinguish between the "budget summary" and what has already been covered above. The point is to be as "explicit as possible in describing the reasons for the various items" and an introductory account of the way requested resources are to be used follows. The personnel, materials, travel, listed below are based on the most efficient use of the model to complete the first phase of the project in the 1991-92 school year.

A) Organization and Support:

Task Force Personnel:

Director
Astronomer Consultant
Research assistant
Educational Consultant
On Site Programmer

Student Programmers (if available)
Communications Consultant
Secretary

Their Duties:

1) Director: M. Thompson
   A) Creative -- designs and writes project materials.
   B) Research -- identifies and evaluates resources.
   C) Managerial --Establishes objectives, organizes task force, allocates project resources, establishes deadlines, supervises staff, prepares reports, attends meetings, and monitors budget.
   D) External Relations -- establishes collaborative relationships with other institutions, formulates dissemination plan.
   E) Teaching -- implements and evaluates materials in classroom.
   F) Revises and refines materials. Maintains pedagogical guide.
2) Astronomer Consultant -- Sallie Baliunas or other. General "pick up the telephone" information source on history, science, resource identification and location. Evaluates pedagogical scheme and product. Much time was spent during the last eight months calling astronomer friends who would put me on to someone else for a cold call, then to another person and so on. In these cases, the process started with my imagining a specific resource requirement, and then asking about it. Use of an astronomer consultant would greatly speed up this process as he or she would call the people, moving much faster through the professional network. In addition, such a person would initially review the proposed pedagogy, suggest additional resources with knowledge of availability. If there are several resources, he or she can quickly select the best. The person will also review the final product for historical and scientific accuracy and make suggestions for refinement.
3) Research Assistant -- Astronomy graduate student

Nuts and bolts work on obtaining and translating science resource. Often, identity of the resource (usually data or images) for the pedagogy requires a number of hours of research in the literature by a person familiar with it. Then a source needs to be identified and the data acquired in the most usable form. Such tasks are inappropriate for a professional astronomer, but consistent with the knowledge and training of an astronomy graduate student employed as a research assistant.

4) Educational Consultant -- Thomas de Zengotita

   A) Advice -- Reviews ideas on conceptual level with Director.

   B) Initial evaluation of pedagogy -- Reviews printed and computer materials for clarity, ease of access, effectiveness, prior to class use. Edits written materials.

   C) Participant observer -- Attends class with students, executes activities, facilitates and evaluates pedagogy.

   D) Revision -- Confers with Director on revision and evaluates final version.

   At all points in the task flow, de Zengotita provides invaluable input to the project. Our successful interaction on the development of teaching materials in the NSL project, outlined in the duties above, is a pre-adapted methodology for *Galileo*.

5) Programmer

   Executes electronic imaging and interactive programming, including new programs, simulations, resource presentation programs, assist students in program writing. Once the right resource is identified and acquisition assured, revision of the pedagogical design to fit the resource is done. Then the student-computer interactive environment is envisioned and the programmer is consulted for feasibility, magnitude of the programming task, etc. Assuming the general picture is feasible, the specific pedagogy is created and, with the programmer, the detailed interaction (what the program will appear to do or be) is specified and programming and the writing of the pedagogy-text materials occur simultaneously and interactively. Experience indicates that this development plan works in what I call real time -- 3 weeks of pedagogy requires three weeks of preparation work. In addition, ongoing adaptation of standard software (data bases, spread sheets, computation and graphing programs) as the course unfolds is a critical enhancement to the project.

6) Communications Consultant
Designing and establishing communications links (including human liaison) with image data libraries and "live" instruments.
Often historical and live images are immediately available but communications or imaging protocols are missing. A specialist in this area is needed (in fact, right now -- NOAA, Mt. Wilson, Smithsonian).

7. Student Programmers
Student programmers or students with computer knowledge can be very helpful and reduce the programming costs.

8. Secretarial -- J. Vanderbes, T. Richardson, G. Thompson
All of the activities; correspondence, ordering, text preparation and revising, etc., are supported by a secretary.

B) Materials

The materials budget is needed for canned programs, data bases, printed reference materials, and lab and photographic materials. A full explanation of these items would involve the assignments which guide the classroom activities associated with each module. Available if needed.

C) Communications

A crucial part of the pedagogy is receipt of "live" images and data from research installations via high speed communications over telephone lines. Specific data resources extant and waiting for communications links are: Wilson Observatory, NOAA, Hubble Science Institute, Harvard Smithsonian Center for Astrophysics. Potential other sources are NASA's JPL, Goddard Space Center, Joint Institute for Laboratory Astrophysics and others. Compuserve has an astronomy bulletin board which could be a valuable resource and part of the disseminate strategy. In addition, when sources are contracted they often say "What is your computer address? We can just download what you want." We need to establish reliable communications to the research community.

These links will provide the ultimate validation of the "realness" of the educational activities which the new technology makes possible in the *Project Galileo* context.

D) Travel

During the school year, I will need to go to Mount Wilson and the Jet Propulsion Laboratory in Pasadena at least once in order to talk with some observers. I also anticipate going to San Francisco to confer with the owners of Voyager 1.2, Carina Software (San Leanardo) to see if that program can be significantly altered to fit the pedagogy. There is a potential computer expertise resource for the project in Palo Alto called the Institute for Research in Learning with whom we may wish to collaborate. These trips may be combined if the timing is correct, but the effect on the cost is only about 20%. Local trips are anticipated for working sessions with astronomers, for establishing links to research facilities, and to review sites of possible resources.

* * *

Project Manager's Assessment -- *Galileo*:
Malcolm H. Thompson
Teacher, High School Science

The purpose of this document is to address the question, "Has the academic experience for the students enrolled in the 1991-1992 high school astronomy course -- the principle laboratory for the development of *Project Galileo* -- been enhanced, unchanged or diminished compared to the experience of students in the past?"

Astronomy has been a popular and rewarding science elective for eleventh and twelfth graders at Dalton for more than twenty years. The bulk of the roughly forty students enrolled annually consider themselves more able in the humanities then in math and science. The popularity of the course is connected to the nature of the subject matter, the dynamic and supportive nature of the pedagogy and the fact that explanations and descriptions do not rely on an extensive knowledge of and facility with mathematics.

Understanding the academic context in which the project is embedded is crucial to the credibility of the response. The Project Manager is the teacher of the course. His primary concern by contract and by temperament, is to provide the highest quality educational experience for all students enrolled. (Working to that end is what I do.) Enhancements of *current* (as opposed to future) students' experience, knowledge, and capability are the bottom line criteria for all that happens in the course and the project. The mastery of astronomy by the students is the primary goal; how that comes about is secondary. New experimental pedagogies are only implemented if there is a reasonable possibility that they will meet or exceed the learning expectations extant in the conventional course. When they do not (two of ten in *Galileo* did not) then conventional means are employed to bridge the gap. The worst the project can do is break even. In fact, the results of the first year effort transcended our most optimistic expectations.

The goal of the original project design was to supplement the lecture, discussion, homework presentation with computer-based "laboratory" exercises. The discipline of astronomy is particularly well suited to this endeavor because the primary data gathering instrumentation digitizes the evidence at the interface with the real physical world, creating a vast library of computer accessible authentic material. As a result, most professional astronomy is done on computers and school astronomy can closely emulate the process given reasonable access to the information resources and sufficient hardware and software. The thrust of the first year of *Project Galileo* has been to acquire the resources (images, databases, sky simulations) and using standard and specialized software to create an experience-based learning experiences to support the contents of the conventional astronomy course.

The concept and original design of *Project Galileo* predates the Tishman Grant. It was conceived as an extension of a new insight into how humanities-oriented students learn science. The insight emerged from participation in the New Science Literacy Project with Thomas de Zengotita. The success of that project -- its product is now the eighth grade science course -- turned on defining a loftier goal then the one traditionally chosen for such students: learning how to do science as opposed to learning about science. For many humanities students, and many designers of science curriculum for them, this involves overcoming the barrier belief that they are genetically unable to do science. We have found that not to be the case. (The beliefs are so widely and strongly held that there is a *very* high probability that the reader -- based on his or her own school experience -- will react to this last statement with considerable skepticism.)

Overcoming the barrier and learning how to do science only comes from the experience of doing science, for which there was little opportunity in the existing astronomy course. In December of 1990, I became aware of the availability of the vast digitized astronomy resources which could form the substrate for greatly expanded student activity. Obtaining these resources turned out to be easy and inexpensive. By late spring of 1991 many resources were in hand; the first activities had been designed to improve Astronomy; implementation plans with existing hardware were being contemplated. Then the Tishman grant appeared, providing sufficient hardware and the technical support to envision a project whose magnitude is consistent with the state of our knowledge and with the astronomy resources then in hand.

On the following page we give a table comparing the two experiences in 12 categories:

CATEGORY	PRE 1991-92	*GALILEO* 1991-92
Topics Covered	12	13
Text Chapters Read	21	20
Calculations Performed	10	300*
Laboratory Exercises	4	15
Computational Skills Acquired	1	6
Telescope Use	1	1
Astro Hours Per Week (Avg.)	4.5	7
Labs With Teacher Per Week	0.3	1
Reports	2	8
Collaborative Learning Exercises	1	8
Projects	1	3
Original Writing (Pages)	30	40

*Spreadsheets

Above all, the year was characterized by an evolutionary process. Very quickly it became obvious that extensive use of the computer with high quality software, data bases and images offered an opportunity to completely reconstruct the course to one encompassing individual inquiry, collaborative task accomplishment, and projects in an atmosphere of intellectual activity. In effect, to create a resource-laden landscape in which the students with the guidance of the teacher, could do astronomy. Without conscious effort, the pedagogy shifted dramatically toward the ideal Dalton Plan environment. The students planned and structured their time, conferred regularly with the teacher (labs) and with each other, developed their own strategies to accomplish tasks, devised their own pathways through the landscape, and generally took responsibility for their own attainment of explicit goals.

The notion of "LEARNING" as primary -- though often nebulous, mostly test-driven -- course activity became an incidental side effect of "DOING." When alumni of academic courses are asked about the courses they usually say "*We* learned this and *we* learned that." When asked about Astronomy they say, "*I* did this and *I* did that." Yet when asked a specific astronomy content question they will either speak knowledgeably on the subject or ask to what experience the particular concept connects. There is no sense of what they are "supposed to know." There is only an honest sense of what they do know and what they don't know. But what they don't know is not viewed as being beyond their ken. It is simply seen as something not yet encountered and mastered. This attitude makes these students largely indistinguishable from science-oriented students. That outcome is a completely new one for this teacher.

With respect to the particular criteria used to assess student achievement, the results are predictable -- given the context and atmosphere just described.

1) Computer skills were so undeniably and highly developed in this course that *Project Galileo* students in the future are being given computer science credit.
2) Process skills and values were, for the first time in this teacher's experience, actually measurable. Students were not judged indirectly, with inferences about their ability to organize time or their honesty with peers being made on the basis of late papers or chance remarks overheard in the hall. The collaborative and task based curriculum gave the criteria in these categories public expression -- a student's plan for his work was itself subject to a grade, a student's reliability among her peers was on the line in every class activity.
3) As already suggested, the multiple modalities of representation and the ease of calculation provided by the *Galileo* resources brought more students to higher levels of achievement in the math area than I have experienced in this or, indeed, any other science course.
4) The same holds, obviously, for research skills; prior to *Galileo*, there wasn't any real research in my Astronomy course; now, students do research with the same materials they use at Mt. Wilson and the Goddard Space center.
5) Finally, with respect to content the picture is not so *completely* unambiguous. *Galileo* students mastered many facts and concepts essential to Astronomy that students in the past were

barely introduced to -- the meanings of Palomar plate images and the taxonomy of the Star Atlas, for example. In some other areas -- the Planck Radiation Curve or the connection between star magnitude and temperature in Deep Space research, for example -- students in previous courses probably "knew" as much as students in this course, in the sense that they would have given similar answers to an expositional test question. But students in previous courses would have had no idea how scientists actually derive or apply the notions. Larger sorts of framework concepts, like Stellar Evolution, may have been a bit clearer to students who only attended lectures and memorized definitions -- until two weeks after the exam, when they were forgotten completely. But such clarity was often bogus. What was actually clear, in those sentences underlined by student magic markers, was a *model* of stellar evolution, not the actual process by which stars came into being and developed -- let alone the process by which scientists actually arrive at the conglomeration of theories and facts which the textbooks reduces, not to science, but to a facade of science.

* * *

Mathematics

High School Mathematics: Redesign of Program:
Judith Sheridan
Director, The High School

Introduction

In keeping with a commitment to "discovery learning" that characterizes the educational goals of the Dalton School and its plan, the Dalton High School Mathematics Department has been engaged in redesigning its curriculum to achieve a more problem-centered method of teaching which at the same time will deploy technology to its fullest possible extent. The effort to date has focused on an eleventh grade offering, Advanced Algebra and Trigonometry (AAT). During the summer of 1991-92, led by Joseph Akus, High School Mathematics Senior Teacher, four members of the department, Marc Bogursky, Michael Jaffe, Bushra Shamma, and Michael Sturm met to discuss philosophical questions concerning mathematical literacy and education; to review prior work done by individual teachers; and to discuss ideas leading to new assignments which would reverse the traditional approach to mathematics.

The general objectives of their efforts were:

1) To change the teaching method by starting with problems, having students play with them and then elicit from their experience the relevant symbols, definitions, paradigms, algorithms, strategies, methods and procedures based on what the students do. In the past mathematics was taught in such a way that the manipulation of symbols, definitions, paradigms, etc., were taught separate from "practical applications." Only if time allowed would practical applications be presented. The methodology is to be reversed.
2) To change the teaching style from a teacher-centered experience, where the teacher presents problems and solutions standing in front of a class of students at their desks, to a student-centered environment. The classroom becomes a laboratory of exploration, where the teacher becomes a partner with the students as everyone works together in small groups,

or as a class to discover and move in unpredictable ways.

3) To employ new technology by moving away from traditional mathematics, that in the past has been an exercise in paper and pencil calculations, to calculations that employ calculators and computers. The assistance of computers, which can perform hundreds of operations in minutes, allows the teacher not to worry about the correctness of the calculations involved, but instead to focus on "what if..." types of problems.

The members of the department decided to start with a revision of the Advanced Algebra and Trigonometry course, and then to use their experience eventually to construct an integrated 2-year math course for the ninth and tenth grades.

Method of assessing the success of the new assignments:

Students and faculty assessed the new assignments and use of technology throughout the term. Evaluations consisted of:

1) The traditional use of tests and quizzes.
2) Students kept journals as a self-evaluative device, and as a source of key information about the progress of the course.
3) Group evaluations were also a factor.
4) Teachers kept a "Log of Observations"

Technology Purchased

To meet the needs of the redesigned AAT course all the students were given TI-81 graphic calculators which were returned at the end of the year as were textbooks in the past. In addition 5 Tangents were placed in a classroom where AAT would be taught. Also a Tangent was placed in the Math lab.

Curricular Changes

Early on in the discussions to redesign the course the group outlined five mathematical topics which had been covered by the old course and redesigned the assignments to place those topics in a real-life context.

The mathematical topics to be taught were:

- Assignment #1: Solid Geometry
- Assignment #2: Data Analysis

- Assignment #3: Optimization
- Assignment #4: Exponential and Logarithmic Math
- Assignment #5: Trigonometry

The relevant contexts were:

- Assignment #1: Architecture
- Assignment #2: Educational Tests and Measurements
- Assignment #3: World of Business/Manufacturing
- Assignment #4: Finances
- Assignment #5: Periodicity

In the course of the discussion six principles of redesign emerged:

1) The assignment should be *immediate* to the student;
2) The assignment should be built around a *project to be presented*;
3) The assignment would consist of subsidiary projects built up around *questions* which would flow from or support the major project;
4) The assignment would be *open-ended*, allowing for multiple solutions and approaches;
5) The assignment would be defined by a *mathematics saturated context*, entailing continuing encounters with mathematics;
6) The assignment would allow students to make use of all available *technology*.

Summary of Assignments

Assignment #1

Context: Architecture
Major Project: Redesign of the Math/Science Lab
Math Concepts: Solid Geometry/Linear Relationships

The first assignment was designed to be not only collaborative with the students enrolled in AAT, but to include the architecture students enrolled in the Advanced Architecture class offered by Rob Meredith, Senior Teacher in the Visual Arts.

The assignment was designed to lead students to question the use of space, examine the functional use of space, and to provide a cost analysis. The project required building a model of the redesigned space. Students were introduced to the calculators and the use of spreadsheets to arrive as cost estimates for reconstruction.

Mathematical concepts involved: units & measurement, real number operations, order of operations, percentage error, estimation, unit conversion, cost functions, ratio & proportion, similarity.

Assessment

This first assignment was generally felt to be the least successful by the faculty and students. Students were not acclimated to working in groups. They had come to expect mathematics to be an individualized program. On one level, they were not sure how to proceed -- what to do first; how to get organized; how to set up group structures. The teachers edited weekly assignments to try to offset this problems. They provided sub-projects. But problems persisted.

Secondly, most of the students we have in AAT did not feel confident about what is understood as a "geometric sense."

The architecture students soon dominated the project.

Finally, their interest in redesigning the Science and Math lab space was not as great as was hoped. In the future they may be asked to design a student lounge.

Assignment #2

Context: Education & Tests and Measurements

Major Project: Design a High School Mathematics Entrance Exam

Math Concepts: Statistics and Probability

The assignment explores the nature of standardized tests (PSAT, SAT, Achievements). Students evaluate criteria (What are they testing? How valid are they? What are they used for?) Spreadsheet formats were used as a way of compiling then summarizing data. From a purely mathematical perspective, this led to understanding the development of central tendency concepts, dispersal concepts, as well as linear regression analysis in statistics.

They were asked to design a test and consider what is mathematics.

Mathematical concepts involved: linear relationships, linear regressions, mathematical modeling, non-linear relationships, function notation, slope & rates of change, error & best fit, domain & range, means & standard deviation, correlation coefficient.

Assessment

A more satisfying assignment, yet problems in group work still had to be overcome. In addition, test designing is a unique skill. Students found the project a bit overwhelming, for example, designing the four options in a multiple choice project.

Assignment #3

Math Concepts: Optimization & Polynomial Algebra

The goal of this assignment was to more fully develop students' algebraic skills: generalization to the polynomial level. In this assignment a single over-riding project proved elusive. In place a number of smaller projects were assigned.

Students were expected to use reiterative procedures to arrive at vector patterns and functional relationships. The spreadsheet was used as a way of setting patterns of increase and decrease. From a purely mathematical perspective, this was an intuitive development of the concept of limiting value.

Sub-project #1: Came from a problem solving exercise where students were asked to fold over a plain sheet of paper to form the largest possible triangular shape.

Sub-project #2: Came from a real life situation in which a person wanted to build a garage and needed to calculate the cost, based on the minimum amount of concrete needed to construct frustums to support the roof beams.

Sub-project #3: Came from the classical "packing" problem where we actually gave students three baseballs and told them to design the most economical packaging for them.

Mathematical concepts involved: functions & graphs, algebraic manipulation, polynomial & rational expressions, linear systems, graphic modeling, maximum & minimum.

Assessment

This assignment was more successful than the first two. Students were comforted by the return to algebraic symbols. They liked seeing the correlations between geometric shapes and algebraic formulations. They understood and appreciated the use of the graphic calculators to accomplish the task. Students had gained a greater fluency in the use of graphic calculators.

The assignment was individually structured, which gave students greater comfort.

Assignment #4

Context: Finances

Major Project: Create a Financial Portfolio

Math Concepts: Exponential & Logarithmic Math

This assignment was designed to introduce students to the financial world in which they live. Not only did it allow students to learn to manipulate the mathematics involved, it lead to a number of discussions concerning the nature of the standard of living, poverty, financial security and other sociological issues.

Students created a financial portfolio with clear aims: to prepare for retirement, to save for college, to build a house.

Students were expected to make use of the matrix pattern of the spreadsheet in order to generate "what-if" scenarios.

Mathematical concepts involved: compound interest, distribution patterns, exponential functions, logarithmic functions, graphic modeling, probability theory, permutations & combinations.

Assessment:

The assignment was positively received. There was heavy reliance on the calculators.

Assignment #5

Mathematical Concepts: Periodicity, the study of trigonometric functions

This final AAT topic exposed students to further developments in trigonometry. Moreover, it further developed student's geometric sense on a more sophisticated level. The project students were asked to work on consisted of two major parts. First they had to translate linear measurements into the sinusoidal curve. Secondly, they were asked to play with more sophisticated transformations of the same.

Students were expected to convert the matrix pattern of the spreadsheet into graphical representations. They were asked to use the grid pattern of the spreadsheet format to assemble trigonometric tables and then to convert them into graphical representations. This lead into the development of harmonic and periodic patterns as well as the sinusoidal curve.

Mathematical concepts involved: right triangle trigonometry, circular trigonometry, harmonic functions, slope & rate of change, limiting value concepts, derivatives, polynomial functions

Assessment:

This was the first group project that seemed to be very successful. Students were asked to work in pairs. Computers were in place in their classroom. Most students felt that there was something magical about entering in a formation or a set of numbers, pressing a button, and having a graph appear. They were fascinated and willing to explore the meaning and interpretation of graphical results.

Assignment #6

Originally designed as an open assignment to be determined by the individual faculty member, most applied the calculator to arrive at an algorithmic way of programming.

This assignment was the most calculator-intense of the assignments. It was specifically designed to explore the use of the programming capabilities of the calculator. Students were expected to arrive at sub-routine programs for solving specific math problems. For example, they were given the task of arriving at the quadratic formula -- something which they had memorized from prior course; but which now they were to arrive at by way of computer programming.

Assessment:

An important assignment to which more time must be allowed in the future.

Concluding assessment to date:

In many cases, the projects involved group work. Students and faculty will become increasing acclimated to working in groups as this collaborative method is applied in many areas of the middle and high school curriculum.

The technology, especially the use of calculators, was widespread throughout the course. The use of the computer became more of a factor when the classroom was fully outfitted midway in the term. Next academic year the computers will be in place from day one.

All the assignments are being revised over the summer to take in account the recommendations of students and faculty.

The use of technology in the High School Math Program promises to proliferate. Presently many programs, *Mathematica*, *Geometer's Sketch Pad*, *Excel*, to name a few, are being explored and will be integrated throughout our program.

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English

Playbill -- Teacher Evaluation -- Synopsis:
Steven Bender
Chair, High-School English Department
Spring, 1992

Introduction:

Although the results of the student work on *Macbeth* during the *Playbill* unit were uneven, the experiment was an energizing and interesting one for myself and (I hope) all involved. I witnessed a new type of student empowerment in the classroom -- as students began to carve out areas of Shakespeare's play for multimedia, hypertextual investigation, classroom dialogue became less a linear dialogue between teacher and student and more of an active inquiry & conversation between student and student. While this represents a positive shift in the classroom dynamic, it is clear, in retrospect, that I as teacher could have been a more forceful presence in helping to shape these conversations. Asking students early on to define a group project on a play as complex as *Macbeth* is a formidable task. Groups did come up with interesting ideas (the role of women in the play, the nature of tragic responsibility, the motif of "intemperate" weather, etc.). Still, most of the ideas were overly general and because the time for the unit (approximately six weeks) was short, the students felt compelled to plunge into their work without the kind of detailed fine-tuning and teacher guidance that would have helped them to define, explore and shape their ideas more clearly.

Student performance on the final examination for the Introduction to Drama course and their contributions to class discussions on *Macbeth* (along with their *Playbill* projects) convince me that most all of the students involved in this experiment did learn a great deal about this Shakespearean play on their own. Most of them learned how to navigate through a complex hypertextual environment with real deftness. Having watched the Orson Welles and Roman Polanski film versions of *Macbeth* made at least some of the *Playbill* students think harder and more meaningfully about directorial interpretation of drama.

While the large database of secondary critical resources was not put to great use by many students, I remain convinced that the very fact of its presence does something to make students aware of the variety of interpretive possibilities open to them. Most students, in questionnaires I asked them to write, agree with my assessment that *Playbill*'s tools are good ones. The question that remains after the first iteration of this project, is "What is the best use we as teachers can put these tools to?" Before attempting to address this question, I'd like to point out two of the greatest problems I confronted this Spring:

1) Time: I tried to track students' free time and their use of the *Playbill* facilities, and quickly learned that Dalton sophomores don't have the lab time necessary for the kinds of projects we envisioned. This coupled with the fact that the project couldn't exceed six weeks (without eating into other works to be covered in the Drama course) means that we need to rethink our expectations of what students can accomplish during the unit (as well as what the very nature of the unit should be). The amount of time it took students to familiarize themselves with the working of the network, as well as with the processes of saving and retrieving work was also greater than expected.
2) Space: Room 509 was ill-suited to this class -- the room is claustrophobicly small when filled with students (not to mention the heavy adult presence -- observers, video-tapers, etc. that unfortunately intimidated some of the students). The class needed to constantly keep track of what room they were meeting in as well as of when the work-stations would be available during their lab time.

We need to do more to ensure that the logistics of time and space available for projects of this kind do not undermine the goals of the projects.

Student Work on *Playbill* -- The Evaluation Grids:

As chairman of Dalton's English Department, I was very interested to see how the kind of work generated by students using *Playbill* compared with the work of students involved in a more conventional English class. To this end I developed a grid of evaluative categories for my students. Some of these categories (literature and research skills such as tracing motifs and symbol etc.) are the same ones I'd look for in a conventional classroom unit culminating in an essay or test. Other categories were more particular to this experiment (student ability to navigate/browse a hypertext environment, to create links, etc.)

When I looked over a range of papers on *Macbeth* from a conventional classroom after "reading" my students' *Playbill* hypertext work, it was clear to me that while the conventional essays seemed to be more organized and "tighter," they were, in reality, more formulaic and certainly more influenced by what the teacher had told the students in class. What is most impressive about the student work on *Playbill* is that so many of the students score highly in categories like "cross-referenced readings" and "synthesis of ideas," in light of the fact that this referencing and synthesizing was done independently of teachers telling students what they were looking for. The story that the *Playbill* evaluation grids tell is one of work that is (for most students) less shapely, but hopefully more genuine.

The brevity of the unit did not allow all of the students to attain the same level of technical prowess with *Playbill* and its resources. Several students seemed to almost intuitively grasp the nature of HyperCard, and the grids reveal that these are the students who made the best and were able to most eloquently navigate through data and the file system. The grids also reveal a definite correlation between serious work/comprehension and students who made best use of the human resources we made available to them (especially the technical point-man for the project, Adam Seidman). A glance at the grids also confirms an obvious point -- the students who were best at planning activities in advance and working in collaborations with their peers are the ones who produce the best work.

Directions for the future/Recommendations:

The possibilities for the future of *Playbill* are exciting and represent important paths toward a new English pedagogy. Still, if we are going to expect our students to work in collaboration with each other, to make use of critical resources, to do innovative in-class presentations, it is clear that teachers will need to take a more active role in working with students to teach them how to do these tasks. More collaborative exercises should be built into units prior to the *Playbill* unit.

Exercises using the kinds of resources in *Playbill* should also be built into the curriculum prior to the *Macbeth* unit. Another English teacher, Jacqueline D'Aiutolo has already begun this process. Taking cues from my initial experiment with *Playbill*, she successfully led her Introduction to Drama students through an investigation of specific problems/questions about the play that called for teacher-directed use of *Playbill*'s resources for their answers. The students worked independently, in collaboration with each other, and as a class, to use the new technology to enhance their understanding of some of the *Macbeth*'s complex themes and characters.

I think it is essential that the *Playbill* work stations reside in the classroom rather than in a special computer lab. When this is the case, the kinds of questions that one uses *Playbill* to address will become a regular part of all class discussions and students will become more comfortable with the program and its resources (as it was, after six weeks, I think these resources were still considered somewhat "other" by most of my students). Text-browser word searches, glances at directorial interpretation, accessing the opinion of a scholar about a particular scene, will, ideally, become part of the normative classroom experience.

It is clear to me that we should reclaim *Playbill*'s resources as genuine research (as opposed to presentation) tools. The best way to proceed, in my opinion, is to take the weight off of the idea of the "mega-project/presentation." This can (and will) be done by generating a list of fairly specific analytical study questions for class discussion, etc. that students will work on using the *Playbill* system. These questions could be investigated in-class or for homework (they should be "doable" in a lab or two). Students should be asked to help formulate these questions during class discussions or as homework exercises arising out of their nightly readings; students might even be asked to write "hypertextual" questions for other students to address as a way to familiarize themselves with the logic of the HyperCard environment (e.g. "click this button to see Orson Welles' version of the witch scene. What do you think he is saying by depicting them the way he does? How does Polanski depict them in contrast? If you were directing a film version of the play how would you depict the witches? Why?) During early *Playbill* classes, the entire class (teacher included) could work together to write or answer questions of this kind. This would shift the emphasis from presentation to more vital, organic discussions, generating themselves out of classroom issues at hand.

Playbill has already begun to revitalize the way we teach English and the way students respond to literature (and to each other). This initial experiment has paved the way for even more exciting developments in the immediate future.

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Evaluation of the *Macbeth/Playbill* Project -- Phase II:
Jacqueline D'Aiutolo
Teacher, Tenth-Grade English
August 1992

Goal:

Based on the results of the Phase I experiment I set as my aim: use *Playbill* as a resource tool to enrich the classroom experience thereby not replacing but broadening our class discussions and interpretations.

Procedure:

I tried to keep two things in mind as I proceeded:

1) not to allow the *Playbill* Project to force me to go against my natural instincts as a teacher.
2) to use only those components which were valuable to enriching my students' understanding of the play and which I felt comfortable using myself: videos, text browser, critical essays, CD-ROM.

When I wrote the *Playbill* Assignment for my class, I had not read Joseph Voelker's evaluation of the Phase I experiment, but my instinctive reaction was to structure my procedure in such a way that my class had close reading of the text and class discussions on each act while they worked on a specific assignment which utilized one component of the resource each week. This resulted in a one page piece of writing submitted weekly and a 3-5 page final interpretive essay as part of their final exam. This paper was to analyze a specific topic and use as many of the *Playbill* components as possible to defend a well-formulated thesis.[see attached assignment and calendar]. In order to accomplish my goal the Phase I procedures had to be modified.

Modifications:

1) In the first project the students felt that they were being used as "guinea pigs;" I, therefore, tried to keep the adult presence down to a minimum in the classroom and computer lab so the students felt that they were not being observed and evaluated.
2) I eliminated the final presentation which used "links" for demonstration purposes. The students had instead, in addition to written weekly assignments which utilized a component of the technology, a major essay which was submitted as part of their final exam and which was to be evaluated to assess their understanding of the play as well as mastery of the resource tool.
3) I tried to structure the assignment very clearly to allow for the students to approach each technological component individually each week as we explored an act of the play each week in class.
4) I eliminated the "notebook" to allow the students to work at home and not feel confined to the computer lab.
5) Since working in a group seemed to be problematic on a number of levels in the first project, I decided to allow students to choose whether to submit their assignments individually or in groups, explaining, however, that although the assignment was structured for individual work, they had to work together in groups of three because of limited work stations.
6) I tried to structure the week to allow for both in-class

discussions and computer lab work. One major criticism of the first undertaking was that the students felt that they did not have enough class discussions.

I further set as my procedure:

1) keep the expectations clear to my students
2) meet with each of the students often in lab not only to discuss the play, and their weekly and final papers, but to "check their pulse" for stress or frustration
3) be flexible and alter the assignment to meet the individual and class needs
4) increase the number of in-class discussion meetings as needed

Success of the Phase II Playbill Project:

One way to assess the effectiveness of *Playbill* might be to quote one of my best students, but one who had many reservations about the project. When I entered the class on the last day before the exam and before the final paper was due, she said:

"You know, this paper was actually fun to write."

This was a student who was used to receiving high grades on her essays, but who found writing papers a tedious and laborious undertaking.

The final paper did tell a great deal about the project. Overall, I found their papers to be more interesting to read. They all had no trouble writing 3-5 pages. Many used the critical essays to support their interpretations. They all found some points to consider in the use of the films and the choices a director makes to illustrate the interpretation. They seemed to cite references more frequently perhaps because the text browser brought them through the text more easily as they traced images in the play. The few who used the historical background component on CD-ROM, however, did so without much success.

Clearly, having the paper count as 50% of the final exam grade was an added inducement for them. Not only did it help relieve some of the final exam anxiety, but it gave them something to work toward and more time to complete it.

The topics of the final papers varied in the level of sophistication as essays usually do in a more traditional learning environment. Many students continued to need guidance on the topic to choose. There were, however, some topics that were chosen by what the students discovered during their own research into the critical essays. These led to the formulation of theses which were richer and displayed a higher level of complexity.

Evaluation of the Playbill Components used in the Phase II experiment:

1) Use of the Videos: Although I used the demonstration equipment to introduce the class to the project and to view the videos to see how Welles and Polanski differed in their interpretations of the witches scene, more work does need to be done with the students on "how to read a film." I did give them a critical essay on the Welles production and we did discuss it in class: it was clear that those who worked with me on the essay did use the films better in their final papers. When we viewed a scene together and discussed it, the students gained more than they did when left on their own.
2) Use of Critical Essays: Again, students need more instruction on how to work from secondary sources. I did a preliminary assignment using criticism on *Hedda Gabler* before we began the project, but again the students who made better use of the criticism were the ones who were given instruction by me in lab. Students left on their own to use the essays varied in their effectiveness in the final paper. This might be an area to develop throughout the curriculum.
3) Use of Text Browser: This seems to be the most accessible tool for students. They learn quickly how to use it and they easily recognize how valuable it is when they are trying to trace an image. The short paper on imagery was the best of the weekly writing assignments.
4) Use of Historical Background CD-ROM: The weekly project on this component was eliminated because of the

time constraint, and those who did use it in the final paper did not use it well. Although I did discuss Act IV scene iii in class and did refer to the historical implications, this component might be utilized better in connection with their history classes. Certainly the students who used it found it visually interesting.

Main Difficulties -- Time and Space:

1) Time: Students need time to read the play through first for content, and then they need to have "hands-on" time to learn how to use the equipment. I structured my assignment to be covered in six weeks and since it was the end of the semester, I had no flexibility to extend the project. I felt that I did rush through the play more than I would have liked. Did I feel more rushed than I normally do without *Playbill*? Probably not. I did, however, see that so much more could have been explored had we more time.

   The students did feel that they were given enough time for in-class discussions, since I gave them a choice on many days to decide if they wanted to go to the computer lab or to have discussions with me in class.

   Since the final project was part of their final exam they were given more time to complete it, but yet some still felt pressured.

2) Space: The limited amount of work stations and the scheduling of the labs are clearly the biggest obstacles to overcome. I had to keep modifying my assignment because I did not have access to the labs room, but we all remained flexible and some delays really did work to the benefit of the students in that they had more class discussions and we spent more time the first work exploring the equipment and the videos together.

3) Computer availability: If computers were in the classrooms, there would be no limit to the richness of this project: the resources would be readily available to enrich the on-going discussions.

Conclusion:

1) *Playbill* is a valuable resource tool which enriches the understanding of the play, but it does not eliminate the need for teacher direction and class discussion.
2) Students need to have a working knowledge of the movement of the action and the development of the themes before they explore different avenues of individual inquiry.
3) As a resource tool it allowed the students to delve into material which would not have been provided by me as the sole instructor on *Macbeth*.
4) *Playbill* offers the students the opportunity to explore different interpretations of the play on their own, and not be confined to what is offered to them by the teacher alone.

Ideas for Phase III:

1) Ideally if the computers were in the classroom the tight structure of my assignment could be loosened and the students could pursue individual avenues of interest as the discussions are taking place.
2) More sharing of their findings should be done in the classroom. Although my assignment provided for such sharing to take place after each weekly project [see calendar] time did not allow for it to take place as often as expected.
3) A richer assignment could be written if all the teachers of the Introduction to Drama Course collaborated in the effort. Perhaps even an interdisciplinary assignment could be done with the History department.

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The *Playbill* Project -- Directions for the 1992-1993 School Year:
Steven L. Bender
Chair, High-School English Department
Summer, 1992

I. Introduction/Goals

The successes and failures of the first version of *Playbill* taught by myself and Judy Sheridan last Spring have been well-documented. While we believe that the basic goals of the project (more collaborative learning, less teacher-focused classrooms, a more interdisciplinary approach to literature, to name only a few) will remain a constant in 1992-93, the coming year brings with it some new aspirations and goals for the project as well.

For example, if we are going to ask our students to work in collaboration with each other, to make use of interdisciplinary critical resources, and to do innovative in-class presentations, it is clear that teachers will need to take a more active role in working with students to teach them how to do these tasks, to provide some useful models for student work. More collaborative exercises should be built into English courses using *Playbill* prior to that unit.

Additionally, it should be a goal of the project to build exercises using the kinds of resources available to students using *Playbill* into the curriculum prior to the *Macbeth* unit. This would not necessarily have to be "technological." Last year's *Playbill* students did not have an easy time using the secondary critical resources of the program. Spending some time on a good critical piece and talking about how to read and respond to literary criticism during, say, the unit on *Oedipus Rex* could certainly help prepare and galvanize our students for what is to come (and even, perhaps, get them to look forward to it). Students might be asked to work on various parts of an essay in small groups, and to report back to the class about their part of the article. In this way students could begin to acclimate themselves to three important components of the *Playbill* unit: peer collaboration, confronting literary criticism and sharing findings with the larger group.

My students last semester complained that they felt too much like "guinea pigs" in a scientific experiment, and looking back, it is easy for me to sympathize with them. An important goal for *Playbill* in 1992-1993 must be to make the atmosphere of the "new" classroom a less daunting, more "user-friendly" one. *Playbill* is something that the students (and teachers) should enjoy; it should certainly enhance the pleasures they glean from Shakespeare's *Macbeth*. In order for *Playbill* to be fun, the unit must be entered into with the proper spirit of intellectual playfulness and experimentation. Although students will, by necessity, work in groups, these groups should not be so discrete as to preclude communication and sharing with the larger group. It may very well be (to steal an analogy from *Archaeotype*) that *Macbeth* becomes a rich site for excavation by groups working in various "quadrants." Still, the big picture will not come together until students begin to systematically share their findings with each other as they go along.

As the 1991-92 school year moved to an end, *Playbill* had already begun marching in the right direction. Taking cues from my initial experiment with *Playbill*, (and intuiting much of the counsel we would receive from our outside evaluator, Dr. Joseph Voelker), another English teacher, Jacqueline D'Aiutolo, began the process of implementing some of these new goals for the project.

D'Aiutolo successfully led her Introduction to Drama students through an investigation of specific problems/questions about *Macbeth* (the character of Lady *Macbeth*, the role of the witches, Shakespeare's use of Holinshed's source material, etc.) that called for teacher directed use of *Playbill*'s resources for their answers. The students worked independently, in collaboration with each other, and as a class, to use the new technology to enhance their understanding of some of *Macbeth*'s complex themes and characters.

Along these lines, I think that rather than have students work for weeks on a "mega-multi-media project" a goal for the *Playbill* project in terms of student work should be to have them write short papers (that could be multimedia if the student so desires) that address specific questions that they must use *Playbill*'s resources to answer. This will help us achieve the goal of reclaiming *Playbill*'s resources as genuine research (as opposed to presentation) tools. A list of fairly specific analytical study questions that can be investigated in-class or as homework should be generated -- students should be asked to help formulate these questions during class discussion or as homework. Ideally, the questions should arise organically out of problem areas for students in the work under discussion; students might even be asked to write "hypertextual" questions for other students to address as a way to familiarize themselves with the HyperCard environment. For example, a student who discovers an interesting passage in a critical essay, or a scene in a film (or even a passage in the primary source itself) might lead another student to the passage with a click of button, and also plant some questions about that destination for the student to ponder. I think that empowering students to create questions to help themselves understand the play is an important new direction for us to consider. During early *Playbill* classes the entire class (teacher included) could work together to begin to map out questions of this kind. These short exercises would be less intimidating and more focused, and would certainly contribute more to the ongoing discussion of literature in the classroom. They would help shift the emphasis from presentation to more vital, organic debate, generating itself out of real classroom issues at hand.

II. Goals: Pragmatic/Technical

In order to meet these conceptual/ideological goals, there are certain pragmatic and technical goals that will have to be met. While goals of this kind are often not the most stimulating to address, it is my belief that meeting them is key to the success of a project like *Playbill.*

1) Space/access -- it is essential that a set of *Playbill* work stations reside in the classroom the students are using for the course, rather than solely in a special computer laboratory. When these stations are in the classroom, the kinds of questions that one uses *Playbill* to address will become a regular part of classroom discussions (wouldn't it be great to be able to listen to a student idea about a scene and then instantly "go to the video-tape" or a piece of a critical essay to see how someone else thought about the same scene?). Obviously the larger the role that the *Playbill* work stations play in the everyday classroom experience, the more comfortable the students will become with the program and its resources. A major goal of the 1992-93 version of *Playbill* must be to make it seem less "other" to students, more a natural path to the kinds of investigations that they enjoy doing and already know how to do. Text-browser word searches, glances at directorial interpretation, accessing the opinions of scholars about particular scenes should, ideally,

become a part of the normative classroom experience.

2) Time/access -- The types of assignments we ask students to do on *Playbill* need to be restructured so that they can be accomplished fruitfully (for the individual student as well as for the class at large) in a reasonable period of time. As stated above, "pre-learning " of *Playbill* through exercises earlier in the semester which call for some of the skills necessary to navigate through the program will be worked into earlier units in the course. In this way we hope to cut down on the time and anxiety it took students to get comfortable using the network, saving and retrieving work, looking at criticism, working with each other, etc.

   Last year, I attempted to track my students' free time, only to quickly learn that Dalton sophomores don' t have the requisite lab time to complete the kinds of ambitious projects we initially envisioned. For this reason, I believe it is important that we emphasize the goal of accomplishing and sharing shorter, more focused and clear literary tasks using the *Playbill* system.

3) The interface and data bank -- Although a good deal of time last semester was spent in "cleaning up" *Playbill*'s interface, it remains overly intimidating to some of our less technically-minded students. We ought to experiment with further simplifying the interface, work harder at "hiding" those aspects of *Playbill* that the beginning student does not need. For example, it might be more useful to start the students off with their notebooks and a scene of the play and, say, Orson Welles' version of that scene rather than to present them with a complex "hypertext" notebook with all its linking tools, etc.

   Students who become interested in exploring hypertextual environments in a hypertextual way will certainly be encouraged to do so while other students might be allowed to pursue their research in a more conventional manner.

   As Judy Sheridan points out, the 1992-93 school year should also see us editing the critical data-bank of secondary sources on *Macbeth*. I have a fair sense now of which essays stored in *Playbill* are of most use to students. Some of the more erudite, difficult essays in the bank should be "hidden," but certainly made available to those students who might benefit from their use.

4) Expansion: more classes/more texts -- an important goal of the *Playbill* project for the 1992-93 school year should be to get more students and English teachers using the technology. In meetings at the end of last year in which Jacqui D'Aiutolo, Judy Sheridan and myself discussed our successes and failures with the program, there seemed to be real interest among most of the drama teachers in experimenting in some form or another with *Playbill*. I am hoping that we will see use of *Playbill* in all of our Introduction to Drama sections by the Spring of this year.

   In addition to expanding into more classrooms, we should move to get more texts on line for use with *Playbill* (a list of possible texts was submitted to Luyen Chou before the end of the 1991-92 school year). Even without many other resources (we're well aware of how long it takes to build a vital, healthy database around any work), the ability to do sophisticated word/motif searches, etc., could be very helpful, both to class discussions and to demystifying the relationship between literature and technology for many students.

5) Integration of other tools -- Many powerful tools at our disposal -- CD ROM's like the *O.E.D.*, *Shakespeare's Life and Times*, etc. -- were relegated (at best) to the side because of the rushed nature of the first version of *Playbill*. These tools need to be better integrated into the unit, perhaps by assigning certain students to make specific use of them. Still, if it remains necessary to go to a special work-station to use these tools, they will probably not get the kind of use they should. In any event, it is certainly a goal of the *Playbill* project for the 1992-93 school year to make more meaningful use of some of these ancillary tools. Additionally, resources such as instrumental (Strauss) and operatic (Verdi) versions of *Macbeth* might also be worth looking into for students especially interested in music. Although it did not happen much in the first version of *Playbill*, I still believe that it is important to encourage students to bring new resources to the program because it is important for them to see the program as theoretically open-ended, rather than as teacher-defined.

III. A new experiment for 1992-93

Last semester, I discovered the power (and fun) of E-mail. I was struck by how quickly I began to have stimulating "electronic" conversations with people I didn't see much during the school day. Since we are constantly bemoaning the fact that our classes only last 45 minutes, I began to think about the potential of E-mail as a classroom tool. I wondered if this technology could help a class exist and keep in touch with itself as an intellectual entity outside of the prescribed single-period parameters. In order to try and answer this question and to discover some of the potential of an E-mail system for English pedagogy, I devised an experiment.

The experiment was a simple one. Introduction to Poetry is one of the most successful courses in the English curriculum. Still, it is a course in which I often wonder about the students' engagement with poetry outside of the classroom. The ideal of a course of this kind is to get students to enjoy poetry, to read it on their own, to debate it with their peers. But "read a poem on your own and discuss it with your friends" is, unfortunately, not a realistic homework assignment for the highly pressurized Dalton student. If each of my students had an E-mail account, however, I could actually create an assignment of this kind. A poem (perhaps "the poem of the week") could be posted on an electronic bulletin board; a weekly assignment could be to ask the class to post messages about the poem onto the bulletin board (responding to the poem or to what a classmate has said about it, or asking a question). At the end of the week, the poem could be discussed in class (the messages, which should be signed, could be called up). Certainly, the ensuing discussion would be enriched by the time, thought and (it is hoped) fun that the students had with the poem during the course of the week.

I ran a version of this experiment with several faculty members at the end of last semester. We posted an extremely difficult Emily Dickinson poem ("My Life It Stood A Loaded Gun") that none of us were familiar with. Very quickly, comments and questions began to appear next to the poem. These always served as a springboard for new ideas about the poem. By the end of the week, we had posted several pages of conjecture about the text, and although no definitive conclusions were reached, all involved felt they had a much better handle on the poem. All enjoyed the experiment, and many pointed out how in this marriage of literature and technology, time and space ceased to be obstacles.

I propose that an E-Mail project under the umbrella of the larger *Playbill* begin in at least two English classes in the Fall of 1992 with more classes participating in the Spring semester. It seems to me that an experiment of this kind can take place at any grade level, in any course. While hanging a "Poem of the Week" on a bulletin board makes eminent sense, so does the teacher posting a "Passage of the Week" (from a novel, story or play) that might be fodder for classroom discussion for his/her students to wrestle with during the course of the week.

IV. Conclusion

Presently we are aiming to fine-tune *Playbill* so that our students can reap the greatest benefit from it. The 1992-93 school year will see a refinement and editing of *Playbill*'s tools and interface, combined with an expansion of its use in Dalton's English curriculum. The use of technology in the study of drama will be introduced into more tenth grade English classes. New, more sharply focused questions and exercises for students to explore using *Playbill* will be developed. New texts will be selected for new versions of *Playbill* that could be employed in courses on other genres of literature as well. While the investigation of poetry or a novel might not benefit as much from the access to the video as the study of drama does, the search features of the program, the potential critical resources, and the eventual integration of tools like the *O.E.D.*, all urge students in the direction of the kind of close-reading that enriches the study of all literature. Filmic interpretations exist for a significant number of the texts now taught in the now taught in the English Department. Courses in which interesting and relevant video exists should begin to use *Playbill* for at least those portions of the courses. As the English Department offers courses that are increasingly inter-disciplinary in nature, there should be even more fertile ground for *Playbill*.

It is our instinct that it is more important to introduce technology into the English curriculum in multiple contexts than it is to have any one class become completely computer-oriented. It is also important, as Judy Sheridan has said, that the technology drives meaningful literary study, without being intimidating to the student (as co-teachers last year, we confronted more "technical" questions from our students than literary ones). Therefore, under the umbrella of the *Playbill* project, we will begin to develop the less unwieldy E-mail experiment described above in as many English classes as possible in the 1992-93 school year. It is hoped that the student who works in the rich environment of the new technology for even one unit will continue to inquire and think about inquiry in ways urged by the *Playbill* environment even in classes that are not making use of multi-media technology.

* * *

History

Civil War Group Proposal:
Tom de Zengotita
Co-Director of the Tishman Project

Introduction: The CD-ROM *Civil War Project* in Context

The Dalton Plan, conceived by Helen Parkhurst and inspired by John Dewey, envisioned education as a process of student driven inquiry, a process in which teachers would act as mentors or guides rather than instructors. In the context of print-based education on a mass scale, the Dalton plan proved impossible to realize in the long run. But, as anyone involved with Dalton knows, it became increasingly difficult over the course of this century to maintain the fundamental ingredients of the Dalton Plan in anything like their original form. Massive social and economic pressures gathered momentum, and the School was obliged to adapt. The bureaucratization of education in the United States led inexorably to formalized standards of evaluation to which classes, texts, teachers, and students had to submit. Gradually, the Assignment -- once a long-range project plan shaped by the interests of the student -- evolved into something more nearly resembling a syllabus with a calendar attached. The Laboratory -- once a place for extended and collaborative study in a particular subject -- became an office space for faculty to meet with individual students. Above all, stood the Schedule and its minister, the Bell. Is it any wonder that, in colloquial student usage, the word "lab" now means "free period?" Dalton has maintained throughout, and maintains to this day, an extraordinary record of achievement through attention to individual student needs. But regarded from the point of view of the original vision, it is the achievement of an extended rear-guard action by progressive forces in retreat before the tide of mass education.

The New Laboratory for Teaching and Learning draws its principal inspiration from the original Dalton Plan and the tradition which nurtured it. In accordance with the goals of the school as a whole, it seeks to initiate, prototype, and manage projects which recover that tradition at the level of educational practice within the school. Drawing upon the resources of interested faculty and students, The New Laboratory explores constructivist approaches to curricular and professional development in the sciences and humanities -- especially through experimentation with new communication technologies.

The Tishman Project, the flagship project within the New Laboratory, has enabled a mobilization of that technology sufficient in scope to make possible a test of its transformative power. With the philosophical armature of the Cumulative Curriculum governing particular projects under the Tishman grant, an attempt will be made to create a technology based educational environment in which the original Dalton Plan can be realized. With an evolving multimedia database and a generic application network providing school-wide access to the Cumulative Curriculum, each project will develop databases and applications within traditional disciplines. Each project aims to enable student to master cognitive skills and information resources related to it's discipline while, at the same time, linking up with other projects simultaneously under development.

Civil War is one such project. It addresses issues specific to historical study in the context just outlined.

Project Narrative

Project Origin

. . . Past efforts to construct a *Civil War* CD-ROM product suffered from what one student called "too much material and no way to use it." As the focus narrowed, first to New York and finally to the Draft Riots of July 1863, things got more promising. The most successful format began with a tour through lower Manhattan in which textual and graphic materials were linked through HyperCard menus to a literal map of the area at historically significant locations. But a fundamental dilemma remained: one wants an environment in which the individual can wander at will through the cumulative curriculum; but one also wants enough structure so that the individual is not lost in a featureless morass of information spreading out in all directions behind the bottleneck of the computer screen. These imperatives are in perpetual tension.

But the narrowing focus raises questions about the larger context of historical studies. Assuming success at the level of the local event, how would one move from the draft riots *per se* "up" to the whole civil war, American History, Modem History and so on? Does it take a special kind of person to sustain the historical imagination over such a journey? Or could a multimedia environment inspire something like that in most students? These are the questions which must guide design of this project from the point of view of overall development in this professional arena.

Project Purpose

The general purposes of the CD-ROM *Civil War Project* will be defined in relation to student-created multimedia accounts of the Draft Riots. From the point of view of content, students should gain an in-depth understanding of the political, social, cultural, and economic issues raised by the Civil War in New York City and a credible introduction to the issues raised by the Civil War in a national context. From the point of view of skills, students should gain the ability to do historical research with primary and secondary sources at a level more usually associated with Graduate School than High School. Students should also gain enough control over computer resources to design and navigate a sophisticated multimedia environment -- including marketed applications like HyperCard, SmallTalk, and DiVA as well as in-house applications like Textbrowser and PictureWindow. From the point of view of pedagogy and philosophy, students should benefit from an extended encounter with classic historiographical issues of bias, framing, data selection and thematic emphasis in historical studies.

Technology Focus

The main activity of students in this project will be the construction of interactive multimedia tours through the Draft Riots. Everything they do will depend upon the new technology. Even the reading and gathering of traditional textual and pictorial sources will be conditioned by the aim of scanning into a data base for the purpose of multimedia production. The papers they write will assume the use of the new technology and address the historiographical issues raised by it.

Student Assessment Models & Issues

Given the focal activity, assessment of student performance offers an opportunity for ground-breaking research and reflection that should not be ignored. At the same time, certain obvious assessment measures can be taken: a consulting historian from the Columbia University faculty will be asked to evaluate student tours, along with representatives from Dalton's history department. Professional evaluators (Bank street?) will debrief students to assess the impact of the project on their attitude toward and interest in historical studies, both before and after the project is implemented. Technology oriented educators from IBM will assess student tours from their perspective. But, more interestingly, the students themselves will introduce their tours to potential participants in the 1992-93 phase of the project -- and *those* students will evaluate the work of their predecessors with a view to building upon it. At the same time, some effort will be made to stay on-line with this year's participants so that we can follow up on the consequences of this project in the college setting. In short, we will work on a portfolio prototype, with the Multimedia Library's Dalton Inquirer in mind.

Unique Problem Areas

Of all the projects falling under the Tishman grant, none promises to instantiate so immediately and dramatically the problem fundamental to this whole project: will the Egg of the Multimedia Library turn into a Giant Glob? How can the Card of the Dalton Inquirer negotiate the Bottleneck of the Screen? Even with the focus narrowed to the Draft Riots, there is virtually no limit to the materials which might justifiably be made available to designers of the tours.

Two members of the Executive Committee and one member of the Multimedia Library are among faculty mentors to CD-ROM *Civil War*. A manageable number of highly motivated (so far) students are involved. A convincing case can be made for viewing this project as a test for the whole concept of a tour as the primary metaphor of navigation in the new environment -- both in the short term, in a single inquiry, and in the long run, over the whole course of a person's education.

Unique Opportunity

In virtue of its unique problem area, CD-ROM *Civil War* also offers a unique opportunity with respect to the whole -- with "whole" taken to mean "historical studies in a mature computerized multimedia environment." Could the Draft Riot tours be a model for entering a nationwide network? Schools everywhere might tailor entry into historical studies in analogous fashion. It doesn't have to be the NYC draft riots -- it could be any definitive historical event that took place locally. Students might begin historical study by realizing the historical imagination in such a local context and confronting from the beginning the enrichment of continuous reinterpretation in more and more inclusive contexts.

Evaluation

Students, Faculty, and Programmer/Designers should submit written summaries of their sense of the project as soon as possible -- and at the end of the year. The Bank street team -- or some outside evaluators familiar with the overall project -- should read the project proposal and the summaries, view available video-tapes, observe some sessions, and interview students and faculty at the beginning, middle, and the end of the year. The evaluation team should then provide the Executive Committee and the project managers with a systematic analysis of the process of the project, covering everything from missed milestones to vaguely defined expectations to poor communication to unexpected opportunities. The understanding would that project managers will have to respond constructively to that evaluation in their proposals for academic year 1992-93.

Dissemination

Within Dalton, the project will draw upon the expertise of members of the History and the English departments in certain areas of research and ask for help from those departments in assessing the student tours. Student assessors will also be recruited. There are always opportunities at the end of the year for departing seniors to display their work and the tours, if successfully constructed, would be a natural for such occasions.

With respect to the larger educational world, assessment proposals also implicate dissemination. Faculty mentors will monitor historical and technological gatherings for opportunities to present and discuss CD-ROM *Civil War* work -- perhaps involving student presenters. Ben Mandel, a student in the course, is working with Dr. Dunnan on a proposal for suspending conventional grades and transcripts. Inspired by a 1932 experiment, they are thinking of approaching a group of influential colleges and universities to secure the co-operation of their admissions departments. If successful, student tours from the *Civil War* course might be a way of illustrating how portfolios of the future could work in those very significant settings.

II. Project Goals

The goals of the CD-ROM *Civil War Project* will all be defined in relation to student-created multimedia tours of the draft riots. Those goals will then be operationalized in the "Program Implementation" section to follow and then scheduled in the final "Milestones" section. I have tentatively divided the goals with the student assessment vs. project evaluation requirements in mind:

Student Achievement

1) Students should gain an in-depth understanding of the Draft Riots of July 1863 in New York City.
2) Students should gain a real understanding of the political, social, cultural, and economic issues raised by the Civil War in New York City.
3) Students should get a credible introduction to the issues raised by the Civil War in a national context.
4) Students should be able to do historical research with primary and secondary sources at something approaching a graduate level.
5) Students should gain enough control over computer resources to design and navigate a sophisticated multimedia environment.
6) Students should understand classic historiographical issues of bias, framing, data selection and thematic emphasis in historical studies.

Program Product

1) Student Tours will employ interactive programming and database sufficient to encourage future users to:
    a) compare the tours
    b) construct tours of there own
    c) move beyond the draft riots to more inclusive contexts.
2) Tourmakers will produce a set of categories (menus and buttons) linking the tours. Each tour will of course have categories not relevant to other tours, but all tours use *some* linking categories sensitive to long-term project.
3) Students will help to recruit and initiate their successors.
4) Tours will contribute to portfolio prototype envisioned by the Multimedia Library's Dalton Inquirer.
5) With their successors, students will explore implications of project for historical studies within the Cumulative Curriculum as a whole. Focus to be on database extension and the development of appropriate linking categories, between the tours -- and beyond them, into the larger context.

III Program Implementation

Objectives and Evaluation Measures

- Historiographical issues in the traditional text-based setting compared to the new communication technologies. Representative Civil War texts are considered in conjunction with the Ken Burn's videotape on the Civil War. Evaluation Measure: date at which student papers were submitted
- Beginning with the Jim Shenton tour of lower Manhattan, the focus narrows to New York and the Draft Riots. EM: dates at which tour took place and tape was reviewed.
- The group learns HyperCard. EM: Date of presentation of student address stacks.
- McKay and Bernstein texts are read. EM: ?
- Individual and team tour proposals presented and defended EM: 11/19 and 11/21
- Written summaries of participants to outside evaluators. EM: dates submitted

- Interviews by outside evaluators. EM: dates of interviews.
- Tours submitted in writing. EM: ?
- Authorities on mid-19th century New York City are invited to address and advise the group. EM: Dates of Jean Gardner, Harrison, Rosen . . . etc.
- Assembly of resources begins (see appended bibliography). EM: Date of first visit to New York Historical Society? Handheld scanner (s) successfully used?
- Other locally available Tools, like Textbrowser and PictureWindow mastered. EM: Date of last consultation with Waldman.
- In consultation with Multimedia Library, a review of Tools available elsewhere: anything from SimCity and SimEarth to Point of View. EM: Date of review of culled items on history.
- Construction of Multimedia tours of the Draft riots begins. EM: Dates at which one or two fully equipped workstations become available to tourmakers and *something* is presented.
- Weekly meetings on resources, linkages etc. EM: dates of meetings.
- Midyear debriefings by outside evaluators. EM: dates of debriefings
- Extra time for *second* semester seniors. EM: Schedule adjustment approved.
- Tours completed. EM: Dates that students show their tours to faculty? To potential participants in the 1992-93 phase of the project? To outside evaluators? To Dalton community? As prototype portfolio to Mandel/Dunnan college admissions people?
- Exit interviews by outside evaluators. EM: dates of interviews.
- Arrangements made to stay on-line with this year's participants so that we can follow up on the consequences of this project in the college setting.
- Plans with successors for extending the project to the whole Civil War. EM: dates of meetings and quality of ideas for 1992-93 project.
- Proposal for 1992-93 submitted. EM: date of submission.

Burns tape and the texts made it possible to meet the goal of raising historiographical issues across the media. Jim Shenton tour provided both an anchor experience for the local tour idea -- the project's central aim -- and a vivid experience of the historical imagination at work, an experience which will set a standard for other tours and pose the main problem for later reflection on more general and inclusive contexts. The handheld scanner seems to be the only way to get essential library resources into the database. The programmer's time is essential, not only for the creation of the tools to be used in making the tours, but also for ensuring that tourmakers can use them. Honoraria for outside authorities seems a sensible investment -- not only for short-term informational purposes but also longer-term dissemination and evaluation purposes. Access to libraries and Societies is integral to the concept, as is the purchase of already available programs and databases which might contribute to tour construction. Provision for video and photography expenses, including editing, may inspire students to close that all-important circle between the communication media (of whatever kind) and the living world which historical studies ultimately address. Adequate workstations for tourmakers are a must. It is already clear that space and resources sufficient to sustain uninterrupted and concentrated labor are essential to success at all levels of this project. Finally, only outside assessors and evaluators can give potential supporters and NLTL staff a credible picture of our accomplishments and shortcomings.

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Teaching History Through Multimedia Technology:
Sarah Shapiro
Student, Twelfth-Grade History

Most history classes in secondary schools (and colleges as well, I imagine) revolve around one source: the textbook. This system is, by its very nature, detrimental to the teaching and learning of history, and prevents students from gaining important historical skills, and making their own educational path. While a multimedia based approach does not guarantee the success of a history course irrespective of the rest of the learning environment, it does encourage it.

History is almost entirely historiography. It is all about reading documents with a critical eye, and learning how to extract what is useful, even from the most blatantly biased accounts. For everything and everyone has some sort of a bias, including textbooks of course. This is not necessarily bad, but it cannot be ignored. That is why it is extremely important to teach history students to critically examine everything When textbooks are presented as fact, no matter how even handed and objective those textbooks try to be, the student is denied an important skill. What students learn is one view of history, instead of learning how to explore and discover history themselves It is as if a math class taught students the right answers to many math problems, but not how to get them. But it is even worse in history where, unlike math, there's no single "right answer."

To say that there's no one "right answer" in history is not to say that there are no wrong answers. There are an infinite number of right answers, but many things fall outside that infinity, just as there are an infinite number of points on a number line between 1 and 2, and yet the number three is not included. Historical "fact" is like a physical object such as a tree in that, like a tree, it does exist in a certain way, and yet there are infinite ways of viewing it-- from above, below, the right, the left, and any conceivable angle in between. It is not possible to conceive of what the tree really "is" without filtering it through our five senses, and thus what we get is only our *view* of the tree. But although an infinite number of views are valid, it would be wrong to say that the tree has pink and purple polka dotted leaves when in fact it is the middle of winter and the tree has no leaves. This analogy holds true for the "facts" of history.

Multimedia technology can provide a solution to the problem of teaching history. By multimedia technology I mean a computer program utilizing written documents, pictures, and video, which allows the student to find his or her own, non-linear way. It is important that multimedia applications not be used simply as "talking textbooks" There is always a great temptation to use new technology in ways that we are used to. But sooner or later its potential will emerge. New technology (such as CD-ROM) has the potential to put a vast range of historical research of all kinds at a student's fingertips, something which a single book cannot achieve What is even more exciting is that new applications (such as HyperCard) can allow the students, with some guidance, to make their way through these resources on their own. This means that they will be practicing the actual skills that history requires. A student will be forced to look at a variety of historical sources, chosen according to that student's interests, each with its own view point and bias. The student will have to examine each item critically, and create his or her own synthesis, filtered through his or her own personal views Never before has it been possible for such individualization to take place in a large classroom environment, and if it really happens it will change our current perceptions of education.

The skill of critical thinking which is so important to history is equally important in most other areas. In secondary schools it is often argued that since most students are not going to continue further with their history studies, it is silly to teach them the skills of an historian It is more important, this argument goes, to give them a basic sketch of historical events in order for them to achieve some degree of "cultural literacy" (e.g., Grant drank a lot *à la* E. D. Hirsch, Lincoln and Washington were great men, etc.). I would argue that a student gains more from the skills of critical thinking, whether they go on to study literature, or become couch potatoes constantly bombarded with advertisements to which they are able to apply this skill.

multimedia technology can enable the teaching of history in secondary schools to advance beyond its current level, now limited by the use of textbooks It can allow the student to develop critical thinking tools and to individualize their study. Critical thinking gives students a tool for life. Individualization has the potential to involve students more deeply than textbooks do because they will feel more in control of their own learning, and can concentrate on what interests them. Thus the application of multimedia to the teaching of history could revolutionize education in a very healthy way.

* * *

Civil War Essay Assignment

The *Civil War* Course Up to the Assignment of the Essay:

This course has from the beginning emphasized the idea that any given historical phenomena can be interpreted from a variety of points of view. After a short "introductory" period at the very start of the year in which we considered the "problems" of interpretation, bias and objectivity, we began our substantive historical work together by looking at four different survey accounts of the American Civil War. In this period, students were responsible for assessing the similarities and differences that existed between these several accounts. Students presented the results of their thinking in essays prepared during the first semester.

The next step was to allow students to chose a topic of their own for special investigation. The selections included such things as theater, women's history, newspapers, the African-American community in New York, and the more general narrative of the events of the draft riots. After selection was complete, students were required to begin preliminary investigations of the primary and secondary materials that might be available for any given subject matter. This involved multiple visits to area libraries and archives. For instance, those students interested in women's history tried to find primary source materials that might allow them to investigate such matters as child rearing practices. The natural result of such an investigation was that topics were refined to what looked like "do-able" proportions.

The Essay Assignment:

The third step was to have the students, now know as the "Civil Warriors," read what others had written on their topics. Their task was to find one or more scholarly, academic books that focused tightly on the topic or historical problem the students had chosen to investigate. To take the previously cited example, the students interested in women's history would read several books or articles on 19th century women's history, and in particular those books that focus on the history of women in New York City in the mid-19th century (to which they would be guided by their instructor). Having selected the appropriate material, each student was then to write an essay of at least 10 pages in length analyzing the intellectual position taken by the writer(s) with regard to their topic. In effect, the student was to write a "book review" that paid special attention to historiographical issues.

Assignment Objectives and Assessment:

The assignment was designed to serve several purposes at once. It was to give the student a fuller understanding of the wider historical "context" of the New York City draft riots, by simply having them read more quality history. It was intended to expose them to the historical method employed in the creation of professional quality, monographic works. It was to provide them with knowledge of the variety of source materials a historian uses to construct a narrative. Finally, it was to acquaint them with the historical traditions in which they will be working. With this preparation, students can now use these works as "jumping-off places" for their own investigations of historical problems.

The essay itself was designed as a test of the critical skills developed by the students over the past half-year. Students were evaluated on the basis of their ability to articulate clearly the "bias" of the author(s) under consideration, their comprehension of the works chosen, and their ability to create an articulate argument about that whey have read.

* * *

Explanation of Evaluative Categories for Assessment of Student Performance in the *Civil War* Multimedia Course

1) Substantive historical

   a) *Events of the Draft Riots in New York City*: ability to give an account of the riots that took place in New York City in July 1863. Ability to include description of the defining events and the groups and individuals playing important roles in them.

   b) *New York City History*: the context of the draft riots, with special emphasis on the socio-economic forces which led to the unprecedented transformation of New York during the 1840s, '50s and '60s.

c) *National History in Relation to Local Events*: an understanding of the national context sufficient to clarify relevance of the Draft Riots on the national level with specific reference to federal policy and/or to long term social developments.

d) *Ethnic and Class Dynamics*: a demographic, socio-economic, and political profile of the City during the Civil War. Particular attention given to the interplay of interests between recent European immigrants, especially the Irish, the free Black community, the Anglo-Saxon middle class, and the Knickerbocker aristocracy.

e) *Role of Women and Gender Issues*: at least one research topic addresses this issue specifically and, once again, the integration requirement will ensure that other projects must reckon with it. This category overlaps substantially with the previous one, as issues of gender, class and race are central to an understanding of women's history. Historiographical considerations are also germane, and are outlined below.

2) Historiographical/theoretical:

a) *Bias and Agenda*: detecting and understanding the circumstances and values which necessarily condition historical writing about any significant event.

b) *Narrative Construction*: awareness of how narrative structure contributes to historical understanding, and to the appropriation of history by interpreters.

c) *Thesis Analysis*: ability to detect and assess the relative validity of a thesis underlying a piece of historical work in any medium (as per the historiographical essays concerning specific research topics).

d) *Source Materials and Media Selection*: ability to assess various source materials and media of presentation. What gets left out of diaries if only certain classes of people can write? What messages do we get from the juxtapositions of pictures and musical themes?

e) *Facticity and Historical Evidence*: students will grapple with the problem of what constitutes a "fact" in history. The problem is concretized with the requirement that they present evidence in their papers and presentations. Is what happened physically at that moment the historical fact or do we only understand what the fact was in the light of context and consequence?

f) *Primary vs. Secondary Sources*: students will compare their own research experience with their analysis of standard texts bringing the distinction between types of sources, and the problems associated with it, into focus for them.

3) Skills Development:

Writing, dialectical, and cognitive skills

a) *Logical Argumentation*: ability to organize ideas in a sequence which reflects, through differential emphasis, a hierarchy of implication and inference.

b) *Prose Clarity*: ability to organize paragraphs and sentences so as to express complex thoughts as lucidly as possible.

c) *Deployment of Evidence*: ability to situate quotations, pictures, descriptions of events, video footage and other resources in the context of an historical argument.

d) *Scholarly Apparatus*: ability to summarize, refer, cite, footnote, append and otherwise support an historical argument by traditional scholarly means.

Research Skills

a) *Use of New York Facilities*: student projects require extensive use of historical resources ranging from the libraries at Columbia University and Lincoln Center to the archives of the New York Historical Society.

b) *Use of Dalton Facilities*: student projects require exploration of steadily expanding Dalton resources, both print-based and multimedia.

c) *Use of Human Resources*: in addition to Dalton faculty and support staff, the project is supported by affiliated advisors including professor James Shenton of Columbia University and the staff of the New York Historical Society.

d) *Command of Non-traditional Source Materials*: students have access to resources for their research ranging from Professor Shenton's tour of lower Manhattan with its emphasis on architectural features persisting since the nineteenth century to archaeological excavations presently underway at Five Points to a variety of interactive software designed to promote new approaches to history education.

Technology Based Skills

a) *Network and File Management*: student projects must be stored, built, managed and integrated across the Tishman network. Students must control the flow of applications, tools, and data into and out of their particular fields of activity within the project as a whole and maintain an integrative dialogue with their peers and project faculty to ensure overall coherence.

b) *Scanning and Optical Character Recognition*: all written resources to be deployed and integrated by the various projects must be entered into the expanding data base in an accessible form. This means that students must acquire competence with page scanners and character recognition technology.

c) *Image Processing*: all pictorial resources to be deployed and integrated by the various projects must be entered into the expanding data base in an accessible form. Students must acquire competence with the technologies and skills needed to complete that task.

d) *HyperCard Browsing & Programming*: students must gain familiarity with data bases in general, and non-linear, hypertextual programming in particular. They must be able to create their own programs in HyperCard that link multimedia data in informative ways.

e) *Database Navigation*: structuring of individual presentations and their integration at the level of the whole project calls for navigational skills to complement the programming made possible by HyperCard.

4) Sources from Which Evaluative Data Will Be Collected

   a) Students will be assessed on the basis of two major papers, several shorter papers, and on their final project which will be a multimedia integration of the diverse elements of their appreciation of Civil War and New York City history. Early papers emphasized an understanding of the complexity of historiography, use of evidence, selection of media, and interpretation. The first assignment entailed a close "reading" of Ken Burns' PBS documentary on the Civil War. Their first major (term) paper entailed a careful historiographical analysis of current scholarship pertaining to their respective study topics. Their final papers and projects will integrate their acquired historiographical skills with a substantive exploration and analysis of these topics. During the second semester, the course will be run in seminar fashion, and students will be required to give regular presentations describing their research on their chosen topics. They will also be required to meet independently and in pairs with Mr. Napoli.

   b) Computer skills are assessed by way of individual and group labs, and computer projects. During the first semester, each student created a HyperCard stack that functioned as a sophisticated address and phone book. The students have gone on to use their newly developed programming ability to begin authoring their multimedia historical presentations.

   c) Both papers and computer-based presentations will be assessed and graded by the three course instructors. In addition, they will be evaluated by other members of the Dalton faculty, and by outside consultants including Professor James Shenton of Columbia University.

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The *Civil War Project* -- Retrospect and Prospect (First Draft):
Luyen Chou
Associate Director, New Laboratory for Teaching and Learning
August 1992

The *Civil War Project* began during the Spring term of 1990 as the result of a small seed grant from the Nimbus Corporation to develop a CD-ROM resource on Civil War history. Initially, the twelve students who began working on the project with Peter Sommer concentrated their efforts on questions of historiography: what data should be included on a CD-ROM used by high school and college students? What narrative or interpretive structure (if any) should be imposed on the data? Were the student researchers mere collectors and recorders of Civil War-era memorabilia, or were they authors themselves by virtue of their selection of data? Should the resource be "open-ended?" Which media-type should be emphasized? During the second and third semesters, under the guidance of Luyen Chou and Phil Napoli, these questions were still being addressed. In addition, the group began to concentrate on the specific design goals of a multimedia Civil War database.

At the same time, the need to begin collecting and processing the data in earnest became increasingly apparent; three bottlenecks, however, slowed the work flow necessary to implement the resource:

- With one scanner (located in room 1002) and one Macintosh with an extremely limited storage capacity, access to the necessary equipment was limited and students found the process of storing data culled from libraries and museums to be tedious and time-consuming.
- Students were also hindered in their attempts to collect material outside of Dalton in its physical form. A lack of sophistication in research skills, the overly ambitious scope of the project and reluctance on the part of private research facilities to provide access to their collections contributed to making research exceedingly frustrating for the students.
- While the initial concept behind the *Civil War Project* was to initiate a "search and store" operation, it quickly became

apparent that software tools (for indexing and searching, linking and authoring, data analysis) would have to be designed to make constructive use of the collected data. Because of the newness of hyper-media and CD-ROM, these tools were neither commercially available nor even conceptually defined. It became the job of our group to engage these tasks — a process that turned out to be as time-consuming as it was intellectually rewarding.

- To these challenges was added our commitment to teaching history to students whose primary interest was not computers and technology but the Civil War period itself. Given the complexity of the tasks at hand, the potential for distraction amidst the technology, the personalities, and other accouterment unique to this course, the question that remains paramount in the teachers' minds is: what value-added does this methodology provide to history students at the Dalton School?

The resources provided by the Tishman grant coupled with evolving institutional alliances and a significant re-working of the curriculum during the 1991-92 school year allowed us to find workable solutions to most of these problems. At the same time, there remain numerous issues that need to be addressed as the Civil War experience evolves from an isolated experimental project to a stable curriculum, and eventually to a teaching methodology that might be more widely employed in different curricular settings. What follows is an account of how we chose began contending with the issues identified above this year, and a general appraisal of the challenges that lie ahead. The final section of this document is meant to provide a brief prospectus for the *Civil War Project* in the context of these challenges.

Report on the 1991-92 School Year

1. Scope

During the second and third semesters, project participants began to recognize just how monumental was the task that lay before them. One student remarked that it was not until she began working on her research topic that she realized that literally everything is relevant to Civil War history. At the suggestion of the content-area specialist, Phil Napoli, the focus of the project was narrowed to an investigation of New York history during the Civil War period. By the spring semester, this scope was further narrowed to New York City history. By the following semester the decision was made yet again to tighten the domain of study and concentrate on the events surrounding the Draft Riots that occurred in New York City during the summer of 1863. At the same time students and teachers alike began to re-conceive the purpose of the project as a whole; rather than create a largely impersonal database of primary materials representing the broad sweep of Civil War history, touching on topics relevant to a broad overview of the period, we became increasingly interested in history as a form of story-telling, and the particular story of our local environs and the Draft Riots of 1863 (in the words of one student) as a "microcosm of [features of] the...America of the Civil War up to the America of today." If Robbie McClintock's notion of the "cumulative curriculum" is embodied in any of the things that have transpired at the New Laboratory, it may be best represented in the discussions and decisions about scope that preoccupied this group. As the participants reconciled themselves to narrowing the focus, the importance of the open-endedness of the project and further contributions by later generations of "Civil Warriors" (whether at Dalton or at other schools that will adopt the curriculum in the future) became paramount. So too did the personalization of the account provided by this group of participants who saw the project as an opportunity to explore their own pasts and share it with future collaborators. A major contributing factor to this revised concept of purpose was the inspirational walking tour of New York City conducted by Professor James Shenton of Columbia University. Professor Shenton's ability to invoke with a point of a finger the phantoms of New York, 1863 awakened in all of us a sense of our place in a complex history .....

With the scope thus defined, the students began the work in September 1992 of choosing topics of interest, researching and collecting materials with a heightened understanding of what they were looking for, and designing their own personal "tours" through the New York City that would be represented in multimedia objects stored on the computer. Where the first group of *Civil War* students saw themselves as research assistants engaged in an archival project that would be of scholarly and commercial interest, students this past year viewed the collection of data and the construction of their tours as the curriculum itself.

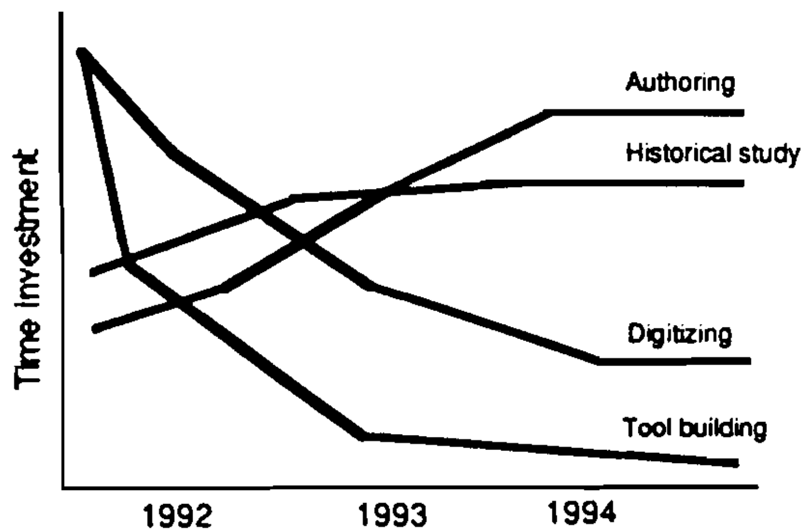
2. Availability of Historical Data

The problem of availability of research materials was addressed by improving relations with Columbia University's Butler Library and the New York Historical Society. In addition, Professor Shenton's formal affiliation with the course as a consultant provided access to his own private materials. While Butler still restricts our students from borrowing books, we were provided with access to the stacks and catalogues. In cases where Xeroxing was not feasible, Phil Napoli borrowed books under his own name. This continues to be a major research bottleneck; while some useful documents are available through the New York Public Library system, the Columbia libraries are far superior in quality for the type of research our students are conducting. They need to be provided the access typically accorded a college or graduate student in order for us to expect work of the highest caliber. Our hope is that with a more formal relationship being forged between the *Civil War* class and Columbia College (see below) this access will be made available.

We initiated a conversation with the New York Historical Society about a collaboration on the *Civil War Project* in the fall of 1991. Since then, our students have been provided what might be termed "inconsistent" access to their archives. On some occasions and not on others students have been thwarted at the entrance to the museum. Duane Watson, the head preservationist, has been an advocate of our project at the Historical and has recommended that we literally sneak students in as we can. He has promised to continue introducing students to the staff so that sheer familiarity might turn the tide against the less accommodating "bouncers" at the museum. Again, while access to the archives is tremendously valuable to the students, it is the prospect of digitizing items in the Historical's holdings that is most tantalizing. We intend to continue to broaden the scope of our collaboration next year.

3. Curriculum and Pedagogy

In keeping with the increasingly cumulative cast of the project, the teachers recognized an asymmetry in the work load (both in terms of amount and type) that might be anticipated in successive years. While this year's class was asked to create a multimedia library with virtually no existing resources on-line, design and build the tools necessary to author their "tours," author the tours, *and* learn about Civil War history, next year's class will begin with a large database of objects, a preliminary set of authoring tools, and a suite of powerful examples in the form of this year's multimedia tours. As illustrated in the diagram below and described in greater detail later on, this will affect the architecture and emphasis of the course in the years to come.



This year, however, design of the necessary tools (link palettes, multimedia card catalog, etc.) was completed only at the mid-year mark, and the actual implementation by the end of the spring break. Similarly, students had only gained familiarity with these tools and other commercial tools (HyperCard, OmniPage, PhotoShop, VideoShop, etc.) by the middle of the spring term. The final quarter saw a mad flurry of scanning, researching, and authoring as the participants sought to finish their tours by the end of the term.

Despite these less-than-ideal conditions which prompted considerable frustration on the part of the project participants, several key course outcomes are worth noting:

- Although considered by the students themselves to be incomplete "works-in-progress," the students' multimedia tours were lauded by visitors (Electronic Learning, Apple, DiVA, among others) and evaluators (Profs. Shenton and Golen) for high production value, and more importantly, for their substantive richness. The editors from Electronic Learning, for instance, remarked that they had seen many student hyper-media works, but none with the quality of content and scholarship produced by the Civil Warriors. Previous years, by contrast, had produced no multimedia work, or at the best, rough prototypes and frameworks for presentations.
- As documented in videotaped interviews with students and in Prof. Golen's evaluation of the project, students universally hailed the course as the most rewarding experience and the "best course" of their high school careers. While this praise was tempered by the frustration and stress largely attributable to conditions described above, and while it is difficult to adjust for the inevitable excitement of being a member of a vanguard in curriculum innovation, the students' testimonial was perhaps the most gratifying outcome of this year's course.
- While students from previous years demanded a separate seminar in Civil War and New York City history to be run in tandem with their multimedia work, this year's class seemed to feel that no such distinction between technological and substantive work was necessary. Seminar sessions during which pairs of students were responsible for leading an integrated discussion of historical and design issues were very successful.
- Students reported feeling empowered to explore the history that was personally important and to connect such explorations with the general narrative framework of the period they were studying. Several students described their experiences as "teaching myself history" (in contrast with passively studying history).

- A perusal of both written (including a final "take-home" exam essay) and multimedia work by the students reveals a high degree of sophistication regarding historiographical issues; each project without exception emphasized a study of the lenses and mechanisms of the historian's work. Marco Roth's project demonstrated a particularly keen sensitivity to these issues. His use of the dramatic script as a paradigm for historical narrative with hyperlinks to multimedia data on the Draft Riots uniquely drove home the creativity and constructivism that characterize historical narrative while at the same time plausibly interpreting the events of 1863. In general, the teachers were pleased to find that attention to historiography did not prevent a significant mastery of New York City history, the events surrounding the draft riots and their relation to larger national issues.
- The interfaces and functionality employed in each of the seven multimedia projects demonstrated surprisingly different approaches to the use of multimedia. One outside observer who is a multimedia developer complained that it was very difficult to figure out from one project to another how to go about navigating the student work. From the teachers' perspective this was an indication that students refused to work from a single multimedia "template," or to duplicate each others' design efforts. During the second semester, the group talked extensively about having to find a new grammar for multimedia work (it's neither essay nor video documentary, one student remarked). The final projects reflect extremely thoughtful, although variably successful, efforts to deal with this problem. Students, for instance, were forced to struggle with the issue of interactivity; where Sarah Shapiro provided a blank text box on each page of her document, requesting that the reader engage the primary material and her own interpretations of it. Leslie Finneran composed a largely expository piece deconstructing and analyzing Ken Burns's Civil War documentary. This attention to interface and functionality contributed to another outcome whose importance cannot be overstated: in all cases, the students avoided one of the major pitfalls of multimedia development (even among professionals). *Each of the projects*

could not have been accomplished as effectively as a text-based report. In most cases, they could not have been accomplished at all without access to multiple media. In other words, these projects were much more than mere "illuminated manuscripts."

- Half of the students in the class elected to continue working on the project after the end of the school year and, in the case of graduating seniors, to remain on-board as consultants to their successors via telephone and electronic mail.
- Professor Shenton decided to adopt the *Civil War* methodology in his Columbia University course for undergraduate history students in the upcoming year.

The greatest pedagogical worry concerns the persisting difficulty we are experiencing in mediating the desire to have students address the broader narrative of American history and their desire to delve into the wondrous details of local historical issues as well as the multimedia technologies. As it stands, a prerequisite of the *Civil War* course is the sufficient mastery of American and Civil War history provided by a survey course. As per the diagram above, we anticipate that future iterations of the course will benefit from increased time for substantive historical study owing to the pre-existence of sturdy multimedia tools, data, and student authoring skills. It remains an interesting problem the extent to which the successes of the *Civil War Project* can be duplicated in a context where the primary purpose of the curriculum is the mastery of grand historical narrative.

This raises a second and equally intriguing issue that we will have to begin addressing during the coming semester. With the wealth of material collected by this past year's class (over 200 MB worth of network-resident digital data), and with an anticipated yearly increase in the size of the database, how much of the existing corpus can we (should we) expect future classes to study and review? Even during this past year students spent little time analyzing the final versions of their peers' work when compared with the time they spent building their own projects. Some students and outside observers have even suggested that each class be forced to "start from scratch" again lest the emphasis on the existing work undermine the purely constructivist nature of the project to date. This is a major challenge that we feel the Multimedia Library project faces as a whole. Without better tools for analyzing, selectively retrieving, and indexing data, the digital library's ability to store may rapidly outstrip the human capacity to cognitively digest.

4. Technology

The *Civil War* benefited dramatically from the infusion of new computer resources at the beginning of the 1991-92 academic year. Problems of access that plagued the efforts of the previous *Civil War* team, while not eliminated, were significantly fewer. In particular, the wide availability of sheet scanners and the ability to store work files to a central file server widened the bottleneck that so hampered earlier efforts to get the project off the ground. Ubiquitous availability of commercial software tools such as Adobe PhotoShop, Microsoft Word, and Caere OmniPage allowed students to work on their projects during lab time and after school at any free workstation.

Access to video equipment proved to be an unexpected and significant enhancement to the course. With the help of video consultant Josie Dean, students became increasingly accustomed to recording field trips such as Prof. Shenton's walking tour and the trip to the Negro burial grounds, important classroom discussions and lectures, interviews conducted with peers and teachers, and segments of Ken Burns's PBS documentary. The purchase of two RasterOps video digitizing boards and a beta test arrangement with DiVA enabled the introduction of digital video into the *Civil War* archive. Through the use of DiVA's VideoShop, students were able to scan video footage into the network.

A major technical milestone was achieved with the implementation of multimedia authoring and archiving tools designed by the *Civil War* team and coded by programmer Bill Waldman. While a rudimentary tutorial in HyperCard scripting was incorporated into the curriculum, the tools developed at the New Lab allowed students to reduce programming time and focus their attention on designing and implementing their tours.

While the technical resources provided by the Tishman grant made possible what was unrealizable only a year ago, we look forward to further technical enhancements that will smooth the production flow and allow students to spend an increasing amount of their attentional energies on substantive historical work. The network, only formally unveiled at the beginning of March, needs to become a stable enough infrastructure that students can count on a relatively "crash-free" environment and a consistent and unchanging user interface. An important problem for the Multimedia Library group to address is the need for logical and consistent paradigms for network-based storage of large-scale archives such as the one produced by the *Civil War* group. Currently, multimedia objects for the *Civil War Project* are stored in folders differentiated only by media type and the alphabetical order of arbitrary file names. While the Card Catalog resource provides a greater degree of user selectivity, it is a program internal to the *Civil War* software suite, and (as a HyperCard stack) is meant only to be a rough prototype of required database functionality. It is crucial that the Multimedia Library team begin to take significant steps towards developing or purchasing more generalizable tools for ordering and accessing on-line resources.

Other prototype tools developed for the *Civil War Project* suffer from similar problems. The linking tools work only within HyperCard and offer extremely limited linking functionality (text string source to text string target or graphical/QuickTime file). No search capabilities exist for students who wish to browse the entire on-line database other than by way of brief descriptive information in the Card Catalog. The architecture of the database also makes inter-project connectivity difficult.

Perhaps the most serious technical deficiency concerns the students' current inability to take their work home. Even in cases where students own Macintoshes, the size of data files is still prohibitively large. A typical QuickTime video clip is 2.5 MB, nearly twice the capacity of a standard high-density diskette! Although dial-in capability currently exists, until multiple lines are implemented operating at a minimum of 14.4K baud with equivalent telecommunications facilities in the homes, this is no more viable an alternative than disks. The New Lab is developing, both on its own and in conjunction with DiVA, strategies and methodologies that would allow students to work off-line on their multimedia projects. This should become a priority development project of the Multimedia Library group.

Video input and editing facilities need to be more readily available. Until it was stolen, students this year had access to a single hi-8 camera for filming and editing purposes. Two RasterOps boards provided satisfactory digitizing quality but were often unavailable because the workstations were being used by other students. Sound input was made possible through a single MacRecorder unit on loan from Luyen Chou. Greater integration of the A/V department's resources and computer facilities is a necessary next step to a full exploration of video's curricular potential. In general, students were frustrated much of the time in their efforts to capture video onto the network because the necessary equipment was dispersed over disparate workstations or simply unavailable. The acquisition of two Video Spigot boards (one a donation from The DiVA Corporation, the other purchased for the Multimedia Studio), three new MacRecorders, a VideoShop site license donated by DiVA, and the new Multimedia Studio on the eleventh floor should help to address some of the specialized multimedia needs of the *Civil War Project*.

Given the high memory and processing demands of multimedia authoring more generally, *Civil War* students frequently bumped against the configuration limitations of Dalton's workstations. The 5 MB RAM standard may have to be raised to 8 MB or higher to accommodate the increasingly voracious memory demands of the applications these students run. Larger displays like the nineteen-inch RasterOps monitor used by Luyen Chou will also become increasingly important for multimedia authoring with multiple windows and palettes. It is interesting to note that in Stephen Landau's recent book on the Brown Intermedia project (*Hypertext*, John's Hopkins Press) screen shots are all taken from large-screen displays which accounts for the relatively uncluttered appearance of the desktop. Again, the availability of high-performance facilities in the Multimedia Studio may alleviate some of the need to increase the capabilities of other general-use workstations deployed throughout the 89th Street building.

Optical character recognition (OCR) technology continues to account for a major bottleneck in the work flow. While new versions of OmniPage provide relatively reliable recognition rates when dealing with original copies of recently printed material, the quality of much of the primary textual material for a Civil War database is too poor to scan with any accuracy. We are trying to acquire an upgrade to OmniPage Pro which may help somewhat, but ultimately we will have to wait for this technology to catch up with the demanding requirements of this project.

1992-93 and Beyond: a Prospectus

1. Scope

The goal of the *Civil War* experiment, as specified in the original project proposal, is to model a pedagogy that could become the core of standard history curricula. While the high quality of scholarship regarding the Draft Riots produced this year is undeniable, we have yet to determine whether the excitement students experienced studying their local histories can catapult a broader inquiry into national history, and whether this excitement can be sustained in the process. As it is, students complained bitterly about being "rushed" through their studies. This coming year our hope is that we can begin to address this need for a widened scope in the following ways:

- Using the multimedia data and tours authored by this past year's participants as a platform, we plan to broaden the scope of the course this year to encompass nineteenth century New York City history. Our goal is to set a year by year trajectory towards broader historical themes. In addition, this year's assignment will explicitly emphasize the requirement that students in their multimedia productions make the linkage between the microcosm and the macrocosm. Previous students, in contrast, were not graded on the basis of such linkages.
- In addition, the course will be run in tandem with a class of Columbia University history students under the supervision of Prof. Shenton, and with a class of high school students in

Athens, GA (Athens Academy). This too will ensure a broader perspective on nineteenth century American history as Dalton students are forced to come to grips with the perspective of more experienced students of American history, and peers whose own local environs are located below the Mason-Dixon line. Negotiations are underway with Apple to provide CD-ROM-based archiving of student work on a regular basis so that materials can be exchanged among sites.

2. Availability of Historical Data

As we have mentioned above, we hope to build on our relationships with both the New York Historical Society and Columbia University. With the dial-in capabilities being installed on the Dalton network, it may be feasible this year to permanently locate Macintosh scanning stations at these research facilities and have students store scanned files on Helen. Also as mentioned above, the expansion of the project participants to include students from other schools will increase the amount of material that will come into the network and which can be accessed by Dalton students. At the same time, we are anxiously waiting for the research and publishing industries to catch up with our requirements. Currently, no analog to the massive sky-image digitization *Project Galileo* has profited from exists in the realm of historical research. The Library of Congress has begun assembling its archives in digital form, a process that will require many years to complete. Several commercial libraries on CD-ROM are currently available, although content selection and quality, and file compatibility remain major obstacles to their straightforward incorporation into our own archive.

Our existing multimedia library and the projects developed by the students have excited considerable interest among organizations in a position to speed the rate at which relevant information becomes available in digital form. Demonstrations have elicited enthusiastic responses from publishers (Harper-Collins, which is developing an on-line texts division, and Simon and Schuster), commercial archives (ABC News Interactive, The Image Bank), and cultural institutions (Metropolitan Museum, New York City

Immigrant Museum). We plan to continue pushing such organizations to support our project.

3. Pedagogy and Curriculum

The departure of Phil Napoli, the content-area specialist for the *Civil War Project*, is a setback for the *Civil War Project*. Phil's familiarity with New York City and American history, local cultural institutions, the pedagogy of the *Civil War* course, the students, and the history of the course was instrumental to the success of the course this past year. Both Tom de Zengotita and Luyen Chou plan to scale back their involvement in the course this year as well due to conflicting schedules and the increasing demands of managing the Tishman Project as a whole. Our anticipation is that the relative stability of the software tools and the hardware environment, as well as the pedagogy itself will allow the course to accommodate these staffing changes. Garret Eisler, a Dalton alumnus and a new teacher in the high school History Department will lead the group in our stead with the help of Simone Laverne, Matthew Nathan, and Sarah Shapiro who will be enrolled in the course for a second year. In addition, we are arranging for students in Prof. Shenton's class to work as mentors with their Dalton counterparts.

As suggested by the diagram above, we anticipate a greater amount of time this coming year to focus on historical issues in general. Where last year students were driven by time constraints to focus their energies in the second semester on technical issues, this year's students will begin working with multimedia immediately during the fall semester leaving them more time to do research and consult with one another.

A priority during this upcoming year will be to begin integrating the materials developed by the Civil Warriors into the standard history curriculum at the Dalton School. Teachers from the History Department (as well as other departments) have expressed an interest in perusing the corpus of material compiled by the Civil Warriors and we hope to encourage investigation of the database as a means towards helping teachers think about how they might integrate these resources into their own courses.

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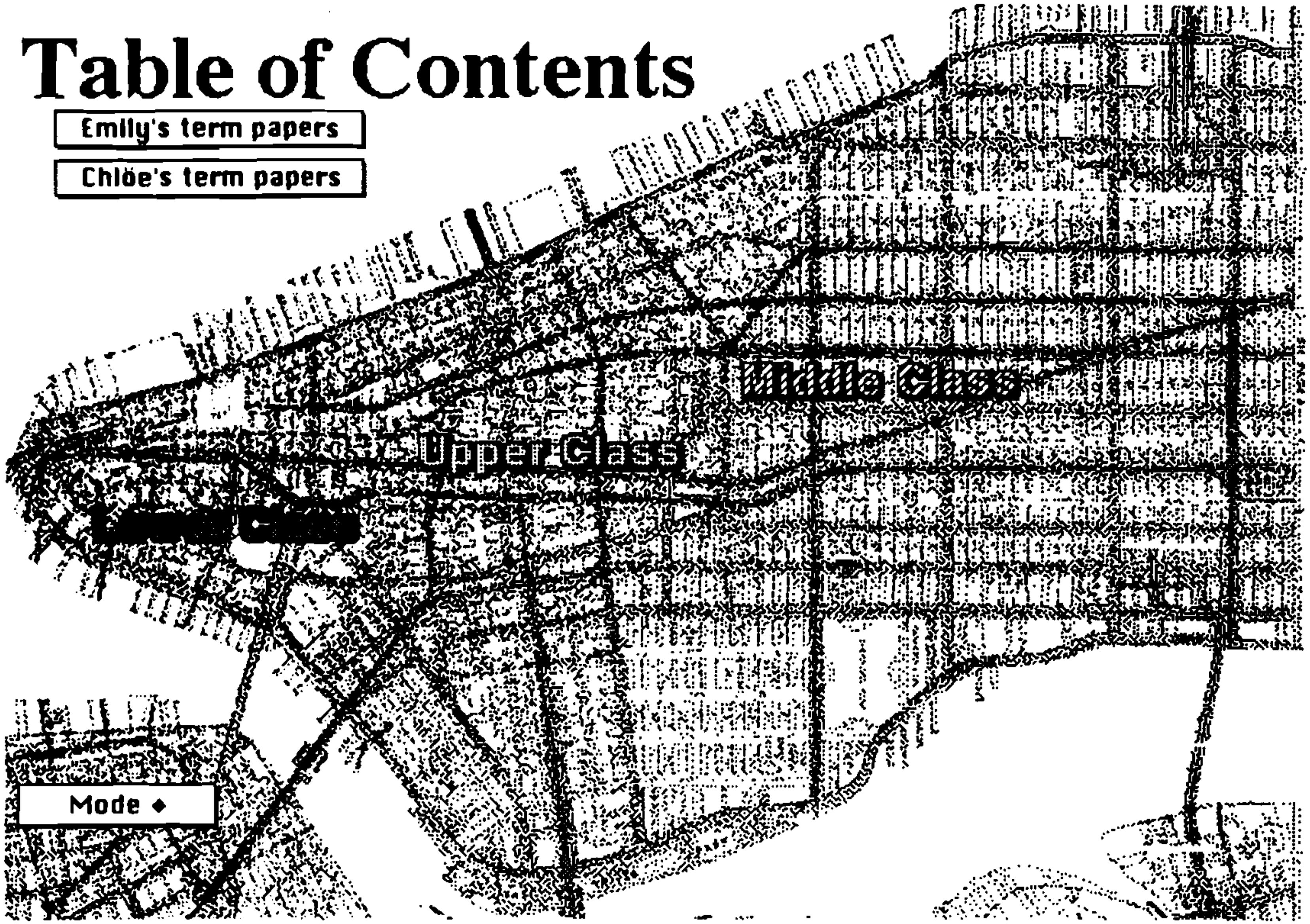

Language

Multimedia and the Study of Foreign Language:
Caren Steinlight
Teacher, High-School French
August 12, 1992

In 1983, Stephen Krashen and Tracy Terrell wrote a book that changed the way I, and many other language instructors, thought about our field. They theorized, convincingly, that second language acquisition only really occurs through a process of naturally occurring language just above students' competency to stimulate without frustrating. Students learn more implicitly, through authentic aural and written exposure, than explicitly through forms and structures. Since Krashen's monitor theory, many in the field have began to regard language as a process, not as a product, as a tool or means rather an end in itself.

But how do we help our students achieve their goal of communicating, of negotiating, taking risks and solving problems in a second language when their maximum contact is three hours per week? It's fine to say second-language acquisition ought to mimic first-language acquisition, but how? Babies and children hear their natural languages throughout their waking hours every day for years before they can communicate effectively. What tasks, what material, what approaches can motivate, stimulate, immerse students in authentic language, model, correct, and reinforce without overwhelming and embarrassing them? This is the enormous challenge facing foreign language teachers.

For the last ten years, I have been reading about the remarkable changes in technology. I am convinced that the innovative power of visualization, the non-linear, interactive, collaborative, iterative properties of multimedia and hypermedia can augment considerably the effectiveness of language learning.

I began work on the project in September 1991 by spending several months on a thorough survey of the enormously rich and diverse fields of language pedagogy and academic technology. I joined such organizations as MLA, ACTFL, Northeast Conference, CALICO, and IALL and have been reading current and back issues of their journals as well as relevant monographs. After a serious immersion in the literature, I was ready to explore in greater depth and detail the areas most relevant to languages, multimedia, and the cumulative curriculum at Dalton. I contacted university language lab and media center directors such as Bruce Parkhurst at Boston University and Otmar Foelsche at Dartmouth; software authors and publishers and not-for-profit distributors (such as PICS and Conduit at the University of Iowa); bibliographers and software reviewers such as Eric Clearinghouse and Professor J. Becker; hardware and software vendors; and various colleagues teaching with and thinking about technology. I studied material about interactionist theories of teaching, communication and task-based materials and approaches, articles, catalogues, and reviews of hardware and software.

On Friday November 22, 1991, Frank Moretti and I went to the University of Pennsylvania to meet with John (Jack) Abercrombie, Assistant Dean for Computing in the Humanities and Director of the Cinema Project, which Judy Sheridan had read about in the *Chronicle of Higher Education*. Jack took us to the lab to play around with cinema. The Cinema Library currently consists of about 20 interactive video disks in 6 languages. We chose "Le Roi de Coeur." The work station (Penn has five of them serving fifty students per week) consists of an IBM PS/2 with a color monitor, a Sony 1550 or Pioneer 4200 video disk player, a Realistic speaker, an AVC playback card, an Ungermann-Bass Ethernet card, an M-Motion video adapter, a mouse, and Microsoft Windows. Students can control the film, which is segmented; they can run it at different speeds, freeze frames, and replay scenes. When they need help they can use the mouse for translations and to obtain historical and cultural notes. There are extensive files on characters, customs, books upon which a film is based, the historical period in which the film is set, and more. We quickly became accustomed to watching the film, listening carefully to the soundtrack, glancing at a window containing a summary (in French) of the dialogue, and occasionally using the mouse to check the various notes available. It was easy to use and great fun; it kept our interest and took the passivity out of classroom film viewing. Among its virtues as a supplement to a course is that it provides students with authentic language at native speed and with all the hesitation and quirks of genuine speech, but it can be controlled very easily. Students can get as many repetitions as they need and can easily find answers to their questions without leaving the spot. Another virtue of Cinema is that it can be used in many causes other than language classes. In April, Professor Abercrombie came to Dalton to demonstrate both Cinema and HyperCard stacks he had written to enrich all 52 lessons of Yale's French in Action Program, which we are currently using in French 1 and 2.

I attended the annual meeting of the American Council on the Teaching of Foreign Languages in Washington, D.C. November 23-24. James Noblitt of the Institute for Academic Technology at UNC Chapel Hill demonstrated "Nouvelles dimensions," a very promising interactive video currently in development. Heinle and Heinle, publishers specializing in foreign language textbooks and software, will be publishing it. I spoke with Charles Heinle about making Dalton a test site and he was quite interested.

At a session on telecommunications I received materials from Juliette Arots and Miriam Grodberg of Wellesley High School and saw a demonstration of a typical on-line session. The value of being on Bitnet was apparent. At a session presenting the French telecommunication network, Minitel, I saw the value of being able to use up-to-the-minute, authentic material and actual communication. It may be that Minitel will be a valuable tool for us in language classes.

Anny Ewing and Rick Altman of the University of Iowa demonstrated Télé-Pics, a video and workbook series available by subscription. The material is excellent: highly interesting, culturally diverse, short, well-supported by accompanying materials. PICS (Project For International Communication Studies) at University of Iowa develops and produces intelligent, solid materials. They are an important member of IBM's newly-formed Foreign Language Multimedia Consortium. Sue Otto, Director of the Language Media Center at University of Iowa and Co-Director of PICS, will direct Consortium activities. All seven members of the Consortium will produce one or more pieces of multimedia software to be field-tested and then distributed commercially or through non-profit channels. I also saw Mac-platform software written by Tom Browne of Macalister College, written to supplement PICS-Télédouzaine. He told me it took him one year to develop. An excellent characteristic is that teachers can change the parameters and it has very good help buttons.

At a session sponsored by IALL (the International Association for Learning Labs, of which I am a member), Jerry Larson of Brigham Young (one of the seven colleges in the IBM consortium) and Tom Browne of Macalister College presented samples of CALL and IAV software. The two best were "Montevidisco," being developed through funds from FIPSE, and "Masha and the Smirnoffs," being developed at Dartmouth. Both were humorous and allowed great student control of plot through ingenious branching in the interactive program. Naturally, I will be keeping abreast of this work. I hope to bring Jerry Larson and Otmar Foelsche (of Dartmouth) to Dalton to show their work and consult with New Lab staff and interested faculty. I hope Dalton will be a beta test site for Montevidisco next year.

Exhibitors I Spoke With

- Transparent Language, Inc. (indexed and glossed texts for reading proficiency
- PICS (non-profit video tape and disk software and materials)
- Hyperglot (commercial software, best of this generation, but...)
- Heinle and Heinle (Système-D is excellent for word-processing in French)
- Conduit (authoring systems and other foreign-language software from Iowa
- Athelstan (software, videos, books on technology and language learning)
- Pacific Lotus Technology (video caption decoder)
- Tandberg and ASC Electronic (along with Sony, best lab equipment)
- Eric Clearinghouse on Languages and Linguistics (excellent source of annotated bibliographies of software and other pedagogical tools)

The best interactive software has the following characteristics: easy "help" buttons; logical icons; high-quality sound; great student control through plot branching and other jumps; explanations of why something is wrong and the choice of a tutorial on the spot; contextualized explanations; teacher control of parameters; notes in the target language; unscripted native speakers; cultural diversity; humor and high-interest material; clear, pedagogically-sound, skills-related goals (e.g.: listening comprehension, reading comprehension).

My suspicion was confirmed that there are many intelligent, creative people out there developing the next generation of multimedia materials. On-going contact with these people will help us avoid re-inventing the wheel as we develop our own materials and will challenge our own creativity as we design and acquire materials. It was an enormously fruitful two days.

At the same time that I was engaged in research and outreach, I also spent a considerable amount of time, in consultation with Frank Moretti and the senior teachers in the language department, evaluating the needs of our French and Spanish students as well as the syllabus -- on particular levels and as a cumulative curriculum. I considered faculty participation, current and near-future technological needs, space issues for hardware in labs and classrooms, time and scheduling issues, and most significantly, the impact of interactive multimedia teaching on the Assignment and Lab. (I am convinced we shall be making a radical return to Parkhurst's principles).

Plans for the Coming Year

Frank Moretti, the senior language teacher and I decided that the creation of a model course would be the most effective way to begin our experiment with interactionist theories and materials. It will be called "French Conversation and Composition: An Interactive Multimedia Approach." Steinlight spent the summer working with application developers at MIT, ordering software, learning to use applications, writing in-class and at-home primary and secondary activities and preparing for the very exciting and challenging experiments students and faculty will be engaged in during the 1992-93 academic year.

Professor Janet Murray, Director of MIT's Athena Language-Learning Project came to Dalton in April 1992 to meet with Frank Moretti, Robert McClintock and me. She left enthusiastic about collaborating with Dalton and the New Lab. In the new interactive French course, we will beta test "A la rencontre de Philippe," written by Professor Gilberte Furstenburg. Professor Furstenburg came to Dalton in July and spent a day teaching me how to teach with this remarkable interactive tool.

We will also test James Noblitt's "Nouvelles Dimensions" and "Système-D." He is a Professor Emeritus from Cornell University and currently a Fellow at the Institute for Academic Technology at UNC-Chapel Hill. "Nouvelles Dimensions," like "A la rencontre de Philippe," is an interactive narrative using level III video disks and a computer. Professor Noblitt will be coming to Dalton to train me and other language faculty in this application.

Dalton will be the first, and perhaps the only, secondary school named as a test site for the best, most exciting interactive multimedia applications in French. We will use the full simulation, "A la rencontre de Philippe," for about 4 weeks in the fall, and other components of the application throughout the year. In the spring we will spend approximately 4 weeks interacting with "Nouvelles Dimensions." In both applications, the immersion in authentic linguistic and cultural context enriches the language-learning environment enormously. The pedagogical values behind these two applications derive in part from Stephen Krashen's monitor theory of natural language acquisition. Students benefit greatly from a high degree of exposure to challenging authentic language without the frustration and constraints of real-time interaction. They have access to tools; they can turn the interaction off; they can ask for infinite repetitions without annoying anyone; they can work at their own pace and take as many or as few risks as their learning style or mood desires.

I anticipate that the high degree of visual contextualization of the idea coupled with the necessity that students manipulate, participate, and influence the outcome (plot) for the characters will make these interactive applications a powerful motivator. Students will work collaboratively, primarily in pairs. They will have access to authentic settings, native speakers, a variety of Parisian locales, a complex "reality" sociologically, psychologically, linguistically and paralinguistically. They will have the tools to locate, repeat, transcribe, define, decipher and alter, thanks to random access. They will brief and debrief each other (with some help from me), and will have both structured and unstructured assignments (copies will follow). All their interaction with the computer and with their classmates and teacher, will be in French.

These pilot experiments will clearly test a number of things beyond the software itself. We will be examining the value and workability of communication-based teaching and interactionist theories of language acquisition. We will test both the teacher's and the students' willingness to regard language as a process, a tool in communication, rather than a product and to accept the resultant errors and unpredictability. We will explore the teacher's ability to relinquish center stage and assume the role of facilitator and stimulator of language production. We will also explore the students' ability to work collaboratively, to react spontaneously, select, interpret, intuit, formulate, take responsibility for their learning.

In that course we will also use other software. Professor Noblitt wrote the best French enriched work-processing program, "Système-D." Using it in the writing process, students have access to a bilingual dictionary, a reference grammar, a vocabulary index and a phrase book. Moreover, "Systême-D" has a built-in tracing device so that the teacher can consult the log of student inquiries. This is useful information not only because it shows what the student wanted help with, but also because it indicates how individual students with their own learning styles use tools in the writing process. I anticipate that by second semester many French students in all levels will be using "Système-D" (IBM-Windows platform).

We will also use Transparent Language, an excellent reading comprehension tool whose premise is that language can be learned intuitively and directly by reading authentic texts (we will be using stories by Balzac, Maupassant and Daudet among others) at their own pace with the help of glosses of words and phrases in context and explanations of structures on line. They can challenge themselves with less frustration using the mouse to access immediate help. I will be using Transparent Language in my advanced French IV as well as in the Conversation Multimedia course, and I anticipate many other intermediate and advanced students using it to enhance their reading comprehension and general proficiency. Transparent Language has texts in Spanish and Latin as well, and we may wish to acquire them during the year.

I will be using Professor John Abercrombie's interactive "Cinema" program in two of my classes. In French conversation we will work with the film "Le Roi de Coeur" and interfaced software, and in French 3 we will use "Au revoir, les enfants." Spanish 4 teachers will use "Cinema" when they want to work with "La historia oficial."

From PICS/University of Iowa we have "Télédouzaine," a videodisk-computer application that is also interactively designed. It contains a great wealth of authentic francophone materials and invites creative use by students and teachers. If the materials are as rich and motivating as they seem, we will order others in both French and Spanish and try them at various levels.

We will also have a number of software programs available to all language students for enrichment, preceptorial needs, lab assignments, etc. These include HyperGlot's "Verb Tutor" and "Pronunciation Tutor" with sound. Access to structural materials and information outside the classroom should free up more class time for meaningful communication and task-based activities. It will enable students to pursue help and practice whenever they or their teacher perceive the need.

Students in the experimental French Conversation class will be keeping a journal all year logging their reactions to all aspects of the project. They will be guided by questions but will be free to record any and all thoughts and opinions regarding software, hardware, their interaction with technology, partners, the class and the teacher. I, too, will be keeping a journal recording my impressions of what works and what doesn't, how we are doing things, how we might alter our way of doing things.

In addition, we will have an intern, Sharon Ainspan, working with us. Ms. Ainspan has a B.A. in history with a minor in French. After several years of computer experience in business, she is now a Masters candidate in the Communications, Computing, and Technology Department at Teachers College, Columbia University. Her particular interests are cognition and pedagogical uses of interactive software. Sharon's presence will facilitate more small group work. For example, three pairs of students can work at stations in Room 507, collaborating with their partner in the computer simulation and comparing flow charts with the other teams (all in French, of course). Meanwhile, three other pairs can be across the hall in the Language Lab working on follow-up activities, peer-editing, interviews, simulations, role-playing, reading, etc.

I am hoping some students in French Conversation will also have the opportunity to use technology creatively. The software VideoShop would enable them to create their own video/computer interfaces; it would be of value both as a took in documenting our collaborative experiment and as a medium for authoring their own multimedia materials. Moreover, the fourth interaction of *Philippe* contains a tool called "Album vidéo" which allows students to select images and segments and paste them into their own mini-application on the computer.

I am very excited about this course. It will not be single-text or even single-medium based. It will not be linear or sequential. The students will be working individually and cooperatively; they will be exposed to a wide variety of authentic materials that greatly enrich their language environment; they will learn their errors of form are natural and that function is more important than form. The students will, I hope, feel empowered as users of the language. They will be learning French and they will be learning how to learn.

While the bulk of experimentation in languages will be the aforementioned, there will be other projects as well. Frank Moretti and Carol Farbar's Vergil Project is described elsewhere. In

Spanish we will be exploring such possibilities as using "El avion hispanico," an interactive multimedia application designed at Cornell University as well as software from Transparent Language, HyperGlot, PICS/Iowa, and others. An exciting possibility for next year is to beta test Professor Jerry Larson's (Brigham Young University) interactive fiction, "Montevidisco."

One of the issues I have been considering is how the Tishman Project in Foreign Languages might benefit First Program and Middle School children as well. I spoke with Dr. Martin Rothenberg about Syracuse Language Systems' new software for young children in their Playing with Language series. I will be approaching colleagues in First Program to experiment with SLS's interactive games and stories in French and Spanish.

The assessment of student performance in French Conversation: An Interactive Multimedia Approach will be challenging for the instructor. There will be some traditional means, such as quizzes, tests, compositions, and projects. But students will also be assessed in their ability to collaborate, participate, interact, take linguistic risk, improvise -- in short, communicate and accomplish tasks. Students will evaluate themselves and each other on such areas as their use of class time, lab time, teacher time, partner time, technological and other resources, their flexibility, enthusiasm, commitment to individual, group and class goals, and so on. Twice each semester, mid-project and post-project, students will be asked to evaluate themselves, each other, teaching, learning, materials, approaches, goals, and progress, tangibles and intangibles. In addition, other Dalton language faculty as well as New Lab colleagues will be invited to participate in projects and assessment exercises. Finally, an external evaluator, an expert in the field of second language acquisition and technology will be invited to evaluate the project as a whole, both during and after.

During the summer of 1993 I anticipate the following activities:

- careful consideration of the year's activities and evaluation results;
- development of specific models and materials for use in French, Spanish and Latin at different levels across the

curriculum;

- consideration of uses of telecommunications;
- further acquisition of software
- possible development of Dalton-created prototype of language-learning software;
- consideration of impact of technology on the Lab and Assignments in foreign languages;
- continuing research and contact with university colleagues working on prototype interactive applications in the field.

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The New Technology and Old Books: Vergil:

Frank A. Moretti
Associate Headmaster, The Dalton School

During the 1991-92 academic year The Dalton School offered a class in Vergil's *Aeneid* in which there were 11 students. In the course of the term the question was explored whether we could create a computer environment for the study of Vergil that would make it possible to both analyze the poem and, at the same time, through a set of expressive tools communicate understandings in ways that are different from the traditional text treatment of poetic meaning. The class explored the use of certain graphic devices such as semantic maps to describe the historicity of single words with the goal of understanding the intended inflection of a particular usage in a particular context and the impossibility of effectively nailing down a single word with a single significance or meaning. Also, the technical foundation was established so that Vergil could be explored through word search capacities that allow one to look for all the occurrences of a particular word in proximity of another word (Boolean Search). This capacity, in conjunction with the *Playbill* notebook, was put on the Dalton School network but not effectively and fully used during the first year.

In the Spring of that same year, discussions began with Dr. Mark Petrini, Assistant Professor of Classics from Columbia University, in conjunction with his evaluation of the *Archaeotype Project*. The assistant teacher of the Vergil class was one of Dr. Petrini's students who had taught Vergil at a college level. In the course of our conversations Dr. Petrini has agreed to collaborate with us in 1992-93 in our effort to create a prototype which would be used in the Spring at Dalton and then in the Fall of 1993 prospectively at Columbia.

In the summer that followed the Spring of 1992, Simone Laverne, a student from the Vergil class, was given the job of collecting all the materials she thought would have been useful for her in analyzing a specific passage with which she had very close contact. She was also given the task of exploring what she thinks would have been the most effective user interface, that is, how should the screen be arranged so that access to data and selected tools would be a possibility. She and Frank Moretti explored a variety of analytic tools: grammars including basic forms and syntax, metrical devices, rhetorical devices, basic vocabulary, interpretive materials ranging from citations from advanced dictionaries such as Lewis and Short, and notes from commentaries ranging from the earliest commentators of the Middle Ages to modern commentators.

Last, and most important, Frank Moretti began conversations with members of the Classics Department -- Carol Farbar, Willene Hull and Stanley Rosenberg -- and they are all eager to be involved in the Vergil Project. All are aware that the potential of the Vergil Project is not limited to Latin Literature; rather, the more long term goal pertains to how the new technology can assist students in reading texts of all kinds, as well as provide them with new means of expressing their understanding. Accordingly, we will also invite the English Department to consult with us in the hope that they may initiate a similar project for English texts. The 1992-93 Vergil class, led by Carol Farbar, Senior Teacher of the Language Department, has 16 students and will test our first prototype in the Spring 1993. Dr. Petrini sees the first prototype being tested at Columbia in the Fall of 1993.

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Art and Architecture

Computers in Art 1 & 2:
E. Jay Sims
Teacher, High School Art

These are sequential courses designed to introduce students to the computer as a fine art medium, as well as to encourage the use of computer technology in the creative process for traditional art mediums. To develop a broad overview of computer art technology, projects will either originate on the computer to be adapted into another medium, or will take existing images and transform them on the computer. The first semester will concentrate mainly on developing drawing, painting and photographic skills in 2-D. Lessons will cover drawing, composition, abstraction, color, perspective, rendering, digital photography, graphics, and design, and students are expected to complete a project in each unit. The second course explores more highly technical computer art programs in use for digital photography, 3-D design, animation, sound, and multimedia.

Computers in Art 1

A. Drawing and Composition: Introduction to basic computer skills.

1. Still-Life Drawing: in black and white do a series of 15 min. studies exploring different drawing techniques, and compositions of objects.

   (Skills: introduction to computer, commands, menus, electronic drawing devices, terminology, and basic visual composition).

2. Use these images and select portions to process further using different illustration programs. Assemble into one composition.

   (Skills: introduction to a variety of drawing & painting programs, cut-paste-copy, moving information between programs, basic composition).

3. Scan in a color drawing and explore color processing.

   (Skills: introduction to scanner and digital photo technology, color composition).

B. Painting and Abstraction: exercise series starts with realism and moves into abstraction.

1. Portraiture and the "Hat:" *Jung said that since the hat is the "crown" of the person, the summit of an individual, it may be said to cover (represent or protect) them symbolically. The hat, since it covers the head, can take on the significance of thought, and by its shape may be invested with specific significance. The choice of a hat speaks the mind, the change of hats -- the change of mind.* Students will photograph each other in a variety of hats in class (using 35 mm Polaroid slides that can be shot & processed in class without chemicals and a darkroom; images can then be instantly transferred with a slide scanner into the computer for electronic processing), trying different light sources to re-define meaning of the act of wearing of 'the hat', then scan the image into the computer and explore image processing in a photo program. Transfer the image into a paint program and explore color and mood, masking, tracing, texture and different compositions. Choose one to print on a laser printer, use it to do a scaled transfer onto canvas or paper, and complete a hand-painted version of the final image. (References: Magritte, Cat-in-the-Hat, Impressionists, Seurat, Chuck Close, Roy Lichtenstein, Jasper Johns, Andy Warhol, half-toned news images, 19th century portrait photography).

   (*skills*: contrasts electronic "painting" techniques with real hands-on painting skills, computer as electronic sketchbook to expand visualization, composition-framing, lighting, color and mood, conceptualization, study of symbolism and narrative image, communication).

2. From the previous study, choose an image and divide it into a grid using a paint program. Explore distortion, magnification, textural, tonal, color changes and assemble into a composition. Do different studies to explore mood and color. Make these into a pattern.

   (*skills*: abstract visualization, composition).

3. From the original exercise choose an image, study the tonal changes and reproduce the image using only geometric shapes, straight lines and pure curves. "Render" the image (depicting color and texture information) exploring texture "mapping" (painting surfaces with other scanned photos, drawn images or patterns), color and shading. Create a new texture to "map" into a shape. (References: Picasso, Braque, Stella, Malevich).

   (*skills*: abstraction, composition, conceptualization of contour and form).

C. Graphic Arts

1. Printmaking Postarization: choose any black & white image from previous exercises and use a computer photo program to break the image into 3 tones of gray. Print the results onto dear transparency sheets with a laser printer. Use these sheets as negatives to expose onto photo-silk-screen film, to make 3 stencils to apply to the silk-screen. Make a (minimum) 3-color silk-screen print edition of 10 prints. (References: Stuart Davis, Robert Rauschenberg, Andy Warhol, comic books, pointillism).

   (Skills: preparation of an image for reproduction and multiple color printings, registration of image, positive/negative visualization, manual dexterity and handling of materials).

2. Try the same process with a color image to make a "color separation" (computer separates the color image into relative amounts of cyan-blue, magenta-red, yellow, and tones of gray).

   (Skills: preparation of an image for print reproduction).

D. Textile Design

1. Create a 2-color pattern or single image on the computer that can be executed by a computer-driven knitting machine or loom. Design a wearable piece of clothing from this fabric. This can be done as a proposal.

   (Skills: conceptualization, knitting/weaving, fashion design, positive/negative spatial perception, preparation of project for presentation).

2. Create a computer-tiled (repeating motif) pattern using a previous image to be silk-screened onto fabric. This can be a proposal.

   (Skills: graphic arts, preparation of project for presentation)

3. Design a tapestry, rug, or stitched project based on a computer image and complete a 6"x 6" sample for a proposal.

   (Skills: conceptualization, preparation of project for presentation).

4. Design a room-sized fiber installation for a hypothetical commission. (3-D) (Reference: Jack Lenor Larson, Gerhardt Knodel, Maria Abromowitz).

   (Skills: visualizing a 2D designed object in 3D space, preparation of project for presentation).

Computers in Art 2: Pre-requisite Computers in Art 1

Computers provide an alternative to photography, drawing, and painting as a way of making images which are displayed within the format of the electronic "frame" of the monitor's screen. Although the electronic picture is assembled by radically different process, basic elements of composition, light, color, and visual communication remain the same. A computer image is digitized (processed as numerical values), which breaks it into adjacent individual pixels (one square unit containing visual information). A computer image can be manipulated at its most basic level, one pixel at a time.

A. Digital Photography

1. Digital Photograms: Adapting a basic photographic exercise (making the shadow image of an object-a photogram) to the computer. Digitize an image of an object/objects into the computer with a scanner. Experiment with light sources to create layers of transparency or shadow, and explore photo processing.

   (Skills: composition, abstraction, 'virtual' -- in effect but not actual -- lighting).

2. Choose an issue, cultural or political, that has personal significance. Create a digital photomontage (combine parts of different photographic images as individual elements making up a single composition) using scanned images or drawn material to make a statement about this issue. (References: Man Ray, DaDa Photomontage, John Heartfield).

   (Skills: conceptualization, communication, composition, cut-copy-paste & layout).

3. Reproduce the photomontage and include type as a major element. Explore different ways to represent letters other then through typed computer fonts, try scanning magazine or think about the symbolic use of the "Word." (References: DaDa, Kurt Schwitters, Political Art, Russian Posters, Barbara Kruger).

   (Skills: conceptualization, communication, typography & layout).

4. Narrative Image: Narrative images infer some kind of story and can be thought of in terms of creating a "scene" or something that shows some form of human interaction. Use a "pin-hole" camera to photograph a "scene" that can read as fictional reality. The pin-hole camera is a primitive photographic device that duplicates the way the human eye receives the transmission of light and image onto the retina. Through a tiny hole, light penetrates the black box of the camera and projects an inverted image onto a sensitized plane (photo paper) in the back of the box. It produces extremely detailed images in the form of paper negatives that can be scanned into the computer. Create a positive using a photo program and explore processing and "hand-painting" it on the computer. (References: Edward Hopper, Mary Cassatt, Tableau photography and portraits of the 1900's, MOMA catalog -- Pleasures and Terrors of Domestic Comfort).

   (Skills: contrasts low & high end technology- chemical and electronic process, photographic composition, conceptualization).

5. Illustrate a poem using graphics and page layout.

   (Skills: graphic design & layout, composition, bookarts).

6. Compose a visual story as a "stack" of related narrative images, designing buttons to advance the story, and incorporate sound. Computers have program formats that are set up to deal with narrative information (printed, sound, visual) that can be designed to sort like index cards, called "stacks," or can progress in a linear manner as slide & video presentations based on scripts. (References: comics, artists' books, filmstrips, picturebooks).

   (Skills: organization and planning, composition, conceptualization, introduction to multimedia and interactive programs, introduction to computer sound).

B. 3-D

1. Spirit Vessel: Think of an imaginary spirit or power that has personal significance, or choose an issue (cultural, political) and design a three-dimensional vessel to contain it using a 3-D drawing program. The object must represent its contents in some visual way. (Reference: ancient sarcophagi, tombs, totems, talismans, medicine bags, charms, symbols, contemporary product packaging, book: "How to Wrap an Egg," computer samples)

   a. Draw the forms and assemble the parts.

   b. Render (paint) the object, assigning textures, colors, and shading to the forms.

   c. Design a new texture by creating an image in a 2D paint program and then copy it into 3D.

2. Make an environment for the object in a 3D modeling program and place the vessel into the scene and adjust lighting. (Skills: spatial perception & perspective, 3D visualization in 'virtual' [in effect but not actual] 3D space, conceptualization, 3D composition).

C. Animation: 2-D

1. Exercises in cel animation (a series of single 'frame' images that create the impression of movement or change when

viewed sequentially) as an introduction to animation concepts, techniques, terminology and computer keyboard functions. Exercises do not stress cartooning, an exacting and tedious process, but teach simple frame-by-frame time and movement concepts. (References: animated experimental films by George Griffin, Robert Breer, Larry Jordan).

a. moving line study -- changing the direction or the shape of a line as it is drawn into each consecutive cel.

b. color, shape, and movement experiments -- changing any factor as shapes are drawn into each consecutive cel.

c. metamorphosis -- one shape evolves into another.

d. collage animation using scanned images as shapes that can be moved in the picture frame.

(Skills: time & movement conceptualization, spatial composition, organization & planning).

D. Animation: 3D -- in 3D the viewpoint of the scene can be assigned from any direction within the 'virtual' space, objects can move around in this space, or exhibit inherent movement.

1. Use the Spirit Vessel, or make a new object and create a "camera" (establish viewpoint) to view it. Move the camera around the object (object movement in space).

2. Move the object (establish viewpoint) in relationship to another object (object movement in space).

3. Move the camera (establish viewpoint) through the object revealing an interior scene and create a vision of this interior or of the contents (create a transition).

4. Design a Jack-in-the Box and animate it. The torso is a complex skinned-object (has internal movement determined by hierarchical linking of forms -- skeletal linking), and the other parts can be solid shapes that are linked or locked to each other in various ways. (References: old mechanical and jumping jack toys, computer samples).

5. Design an animal/fish/bird/bug house/nest/cocoon, create an environment for it and include an image of the animal. Try

combining 2-D animation with 3-D. Use 2D/3D drawing programs, 3D modeling program, CAD program. Do a presentation. (References: book "Animal Architecture," zoos, aquariums, aviaries, dioramas, Wegman-dogs, Butterfield-horses, Audobon-birds).

(Skills: spatial & temporal conceptualization, 3D visualization & composition, organization & planning, presentation).

Students who show a profound interest, skill and achievement in the medium of computer art will at this point be encouraged to continue with advanced creative study in any of these subjects. Throughout the year workshops will be conducted covering topics like these:

1. Computer sound and synthesis-using MIDI (Musical Instrument Digital Interface) sounds can be selected from any audio source, translated into a digital signal (processed as numerical values) and manipulated through computer sound processing programs.
2. Video frame grabbing (using the video camera to scan images) and rotoscoping (tracing frame-by-frame over live moving figures to give an effect of drawn animation).
3. Storyboarding (sketching image/sound/text scripts) and planning a multimedia project.
4. Computer slide shows (still images), CD-ROM (sound), and laserdisc (moving image) in multimedia.
5. Multimedia programs and scripting.
6. Computer art portfolio presentation-taking slides off the computer or using a service bureau to print artwork, computer to videotape.

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Summation

Toward a New Dalton Plan: Reflections on the Tishman Project:
Tom de Zengotita
Co-Director of the Tishman Project

The Venue

The fundamental question we asked was this: how can we make the best possible use of the new technology in the classroom? The New Lab/Tishman enterprise at Dalton is unique, not because of the technology, but because of the attention we pay to educational uses of the technology, to the students and the pedagogy. We are not groping for *goals* ; there is long-standing agreement among progressive educators as to what experiences, habits, attitudes and forms of knowledge we want our schools to sustain. The problem has always been a practical one — how to actually institutionalize the means. The new technology excites our interest because it promises solutions to that problem.

Its progressive tradition makes Dalton an ideal institution in which to launch this enterprise. Indeed, the most striking generalization to be made about all the projects and settings supported by the Tishman grant is this: key elements of the original Dalton Plan are spontaneously emerging in the environment created by the new communications technology. Our seminar/workshop became an extended, though critical, appreciation of the process by which Helen Parkhurst's concepts of the Laboratory and the Assignment are regaining currency. In this document, I will try to summarize that process and our reflections on it.

Readings

We began with a packet of readings which laid out certain contextual considerations. Articles by George Leonard in the *Atlantic Monthly* and by Elizabeth Schulz in *Teacher* expressed a near-universal recognition among educators that this technology is inevitable and that it is going to reshape education as completely as print technologies once did. We are not talking about audio-visual aids or computer courses. The issue is not "if" or even "when" but "how." Excerpts from G.P. Landow's *Hypertext: the Convergence of Contemporary Critical Theory and Technology* and J.D. Bolter's

The Computer in the History of Literacy represented the theoretical attempts of academics to link current intellectual accounts of our cultural and historical context at the end of the twentieth century with certain "hyper" properties of computerized information technologies — properties like "nonlinear," "nonhierarchical," "decentered," and so on. Finally, selections from Robbie McClintock's "Toward a Place of Study in a World of Instruction" and Helen Parkhurst's *Education on the Dalton Plan* brought home the practical point — the educational aspirations of the New Lab and the Tishman project go back at least to Rousseau's *Emile*. The new technologies may be inevitable, and they may exercise a deep influence on our psychology and culture, but we are not necessarily its helpless victims. Traditional humanist values of rationality, equity and independence came first in the history of educational philosophy and they come first on our list of priorities. It is those values which are the real basis of the Tishman Project, just as they were of the original Dalton Plan.

Questions and Principles

Our initial discussions of the readings yielded four thematic questions which we later brought to bear on actual projects and settings in the school. Our constant focus was on the developmental process at the classroom level. Our aim was to tease out the lessons we had separately learned, to see what, if anything, might serve to guide further development. Some general observations seemed comprehensive and clear enough to be treated, provisionally, as pedagogical principles — subject always to modification and revision in the light of experience. First the questions:

1) Is post-modern critical theory important for our understanding and our practice as educators in the hypermedia environment? If so, how and when and to what extent?
2) Does the hypermedia environment pull more students into an authentic learning process and, if so, exactly why and how? How is the process similar and how different across age, gender, learning style, subject matter etc.?
3) Does the hypermedia environment threaten us with fragmentation? Might we lose our common ground — the

canon, the base of "cultural literacy" etc.? And, even if more students do have more authentic learning experiences, what do they actually learn?

4) Does the hypermedia environment constitute a qualitatively new psycho-cultural setting or are we just doing what we always did quicker and better?

The consensus was that the answer to the first question is simply "no," although several participants were struck by how issues raised in the abstract on Monday morning suddenly returned in concrete form when we considered *Archaeotype* and *Civil War CD-ROM* on Tuesday afternoon. There really was something web-like and nonlinear about student presentations in those hypermedia environments, for example, and the teacher's role as resource and guide rather than as central authority seemed implicit in the structure of both projects. That fact is especially suggestive when we recall that the two projects represent opposites on the spectrum of interactive educational strategies which Tishman projects have developed. In the case of *Archaeotype*, a prepared data base and tool suite propel students to interact with each other and with outside resources of all kinds in order to answer the questions posed by the setting. *Civil War CD-ROM*, on the other hand, is structured so that students must comb the relevant resources in search of whatever they need to use for their own multimedia account of historical events. But, in both cases, the teaching and learning process was influenced in ways which paralleled the esoteric accounts in the academic literature.

The principle seems to be:

1) People involved in the development of particular settings and projects need not be familiar with esoteric theory, but awareness of such issues can be useful when people are reflecting on the enterprise as a whole.

The second question led repeatedly to the realization that the most successful projects and settings — and the most successful moments in them — have been characterized by what Luyen Chou calls "the three C's." That is, they are constructivist, cumulative, and collaborative.

The first descriptor seems to apply universally and beyond question, across all the subject areas, grades, gender, etc. Wherever the pedagogy succeeds, students are actively doing something, solving a puzzle, making something, looking for something, *and learning goes on as an aspect of that sort of engagement.* This seems to apply even in areas of the most elementary skills and the most basic information — as shown, for example, in Jackie D'Aiutolo's decision to introduce functionalities of the *Playbill* resource through exercises that questioned the subject matter, in Karen Bass' procedures for teaching keyboarding to third graders, and in the problems which introduce the sky coordinate system to Malcolm Thompson's Astronomy course. The blessings of "constructivism" are especially evident where students feel themselves to be contributors to, and designers of, the course itself — as they did in *Civil War* and *Galileo*, for example. This involves much more than an end-of-the-semester questionnaire; it involves constant consultation with a teacher who genuinely wants to know, and genuinely doesn't know, how best to teach the subject; it involves students actually seeing their pedagogical ideas put into practice as the course develops. In short, it involves the Laboratory as Parkhurst conceived it.

The principle is:

2) Anyone using the new technology in the classroom should design activities in which students are doing something, making something they can call their own.

Realizing the original concept of the Lab as a constructivist principle entails a parallel derivation — logically, but also, we have learned, in practice. Two anecdotes combine to make the point.

One of the most striking moments in *Project Galileo* came when Malcolm Thompson asked students to choose one among several questions and provide a research plan for answering it — a *plan* for answering it, *not* the answer itself. So, for example, one question asked how — given certain resources on the computer and sufficient other opportunities — one might go about proving that Stonehenge was indeed a primitive astronomical observatory. De Zengotita, who was participating in the course and who has done real research before, came up with a plausible plan in fifteen minutes. But the vast majority of the students *were unable to distinguish between the plan and its execution*. That is, they were so accustomed to being asked for answers to problems given as exercises that they had trouble imagining themselves really solving real problems as part of their education.

One of the most successful moments in the administration of the *Civil War CD-ROM* course came when faculty and students began to assign themselves deadlines publicly, in the context of fairly extended and critical discussions of exactly how they proposed to accomplish whatever they were deadlining. In other words, they had to plan in some detail and before a knowledgeable audience just what they were going to do by when. This contrasted with a prior practice of faculty imposed deadlines on the group as a whole.

Now, such plans plus self-selected deadlines are essentially nothing more nor less than realizations of the original concept of the Assignment. There is no denying that it made the monitoring of performance much more difficult, because self-selected deadlines are necessarily staggered. There is also no denying that it was an extraordinarily effective device, which could only have been implemented in the context of a course for which students felt a designer's, rather than a consumer's, responsibility. Thus does the concept of the Laboratory implicate at every turn the concept of the Assignment. And we can readily imagine how the gradual dissolution of the Laboratory into departmental office space went hand-in-hand with the reduction of the Assignment to the syllabus.

3) Students work harder and better if they are executing a plan they helped design in a time-frame they choose themselves.

The "cumulative" descriptor seems to demand a bit more discrimination. It has various and overlapping senses which apply differentially to different projects.

"Cumulative" in the sense of "across the years in the evolution of a single course" is clearly a high motivator but it is not always so obviously at work from the student point of view, at least. It is evident in, say, *Civil War CD-ROM*, where students know all along that their work will be considered and used by students who come after them. But this kind of accumulation is not so evident in, say, *Archaeotype* or *Galileo* or the First Program study of water or Debbie Coon's and Robert Mason's projected use of *Geometer's Sketch Pad*, where each generation of students begins afresh to explore a given field of information. Nor is it clear that what motivates students who know their work will become part of the curriculum of their successors is really distinguishable from the motives of students who simply know that their work will enjoy a wider audience than just the teacher of that particular course and maybe a few classmates at a presentation or debate. Monica Edinger's experience with publishing student work in the traditional classroom setting comes to mind, and, for that matter, what teacher has not envied the kind of motivation which is regularly an aspect of student work in drama, dance, art and sports?

"Cumulative" also suggests "within the time-frame of a single iteration of a course." Here the application is, at least potentially, more uniform across the projects and settings. The gradual accumulation of skills and knowledge in the calibrated sequence of *Galileo* modules or the convergence of interpretations from the four quadrants of the *Archaeotype* site leap to mind as exemplars. But a closer look raises certain questions. It is not clear if the technology *necessarily* elicits or enhances accumulation in this second sense — except insofar as it enhances access to anything at all. Many standardized and text based courses are episodic, but is that a consequence of print? Surely text based courses can be designed so as to incorporate preceding knowledge and activity. Perhaps there is a strong tendency for such courses to be episodic, but, again, how is print specifically responsible? How, for example, do coverage requirements depend on print *per se*?

"Cumulative" also, and perhaps most radically, carries the sense of "over the course of a child's whole development." That sense was fundamental to the original vision of the "cumulative curriculum," but we are years away from being able to make concrete assessments of its application to real experience.

Three principles seem to obtain here, but only one can be formulated so as to apply across the board. They are:

4) Any course materials or student work will be more "cumulative" in a digitized hypermedia environment just insofar as any information is more accessible in such an environment.

5) Students work harder when they know that their work will last and make a difference to the work of others.

6) Students learn more if the sequence of their activities is organized so as to incorporate and make use of what was learned in previous activities.

The "collaborative" descriptor is the most general and sometimes therefore tricky to apply meaningfully, and to assess. The broadest sense suggests sources of information of all sorts which reside outside the classroom — everything from on-line images from Mt. Wilson to copies of primary documents in the New York Historical Society to data from the New York City Water Department. Here, the conclusion is clear. The Tishman projects were systematically collaborative and, again because of sheer access, more so than courses in the traditional setting could possibly be. But people usually mean something else by the term "collaborative."

In our readings, George Landow emphasized the collaborative nature of his hypermedia experiments at Brown University. But a close examination of his descriptions shows that what he had in mind was a collaboration *between documents*. As Adam Seidman pointed out, Landow's emphasis doesn't preclude the possibility that students in the Brown setting were collaborating intensely with each other, but he was clearly more interested in something we put under the label "cumulative." He meant the way in which students at various grade levels "collaborate" with each other, and with established scholars in a hypermedia environment, to produce a particular pathway of inquiry within a field of information. We might call that "collaborative" insofar as it modifies the academic hierarchy, but otherwise it is not clear that our experience with the new technology supports a claim that it is inherently more collaborative than, say, the traditional classroom discussion of a text everyone is reading.

This is the heart of the matter. What people usually have in mind when they talk about "collaboration" is student relationships — the term is contrasted with "competition," and "isolation." One of the characteristic fears of opponents of progressive student-centered education in general, a fear which is only intensified by the possibilities of the new technology (see below), is that it will threaten rigorous conversational collaboration around a common cultural object — a great book or painting or historical figure. They envision capitulation to the most passive and anti-social features of entertainment television and video games. So the most difficult question for us becomes: what happens to student interaction on substantive intellectual matters in the hypermedia environment?

Steve Bender reported considerable difficulty and confusion due to the requirement that students work in groups, seriously aggravated by concern over grades. Malcolm Thompson had similar difficulties when he assigned problems to groups. On the other hand, the *Civil War* course saw very successful collaborations between pairs of students *who had chosen to work together.* It is not clear that the class as a whole collaborated extensively on the substance of the course, though there was a great deal of mutual support in resolving scheduling and technical difficulties and an extraordinary sense of team élan. That was also true of *Project Galileo.*

On the other hand, teachers in the Middle School and the First Program reported great success in collaborative work, whether spontaneous and technical or organized and substantive. *Archaeotype* remains — here as elsewhere — the outstanding case in point. But Karen Bass also emphasized how the technology, and the variety of activities it supported, allowed different students to play the helping role in different situations. That is, she thought the technology contributed to an environment which enables more students to take the lead as a function of the diversity of learning opportunities.

The cunning design of the *Archaeotype* curriculum virtually forces meaningful collaboration within and between teams, of course, but this provisional principle seems justified nevertheless:

7) Collaborative work in formally designated groups at the High School level is more successful when it takes place spontaneously or voluntarily. In lower grades, groups work well even when they are formed by the teacher.

The jury is still out on the third and fourth questions, taken in their broadest senses. It is not even possible, in this space, to summarize opposing views in the "culture literacy" and "multiculturalism" debates of recent years, or to review apocalyptic claims for the global village and the re-oralization of our psyches in it. What quantity of information, made available how fast, through how many different media, will constitute a qualitatively different culture? Are Macintosh desktop analogies (trashcan, etc.) and Tishman book (Multimedia Library) analogies disguising something completely new or making something we already have even better? This much is clear: we simply do not know what the risks and rewards of the process of globalization and diversification under the regime of accelerating information flow really are — and we won't for a very long time. People will continue to stake out positions on these issues in accordance with prior commitments, of course, but evocations of desirable or dire consequences are essentially polemical. What we can do here, in a more ethnographic spirit, is provide a glimpse of how such issues bear on actual practice in the context of the Tishman projects.

Seeing a connection between the open-ended potential of the new communications technology and the ideology of progressive educators, a traditionalist at Dalton might ask: if the canon falls, and individuals are to educate themselves cumulatively by exploring areas of inherited human experience in ways essentially unlimited by judgments of cultural authorities, what will become of us (defined how?) as individuals, as a group, a nation, a people, a culture? And it is important to realize that not only fans of Allan Bloom and supporters of Patrick Buchanan might be concerned with such a question. Many liberals feel the pull of tradition when such issues are raised. So, for example, in the general discussion on Monday, Steve Bender wondered if students using *Playbill* entered *Macbeth* more or less exclusively from the point of view of their own project

— with the enormous field of secondary resources the computer put at their fingertips — would they be able to have any kind of meaningful conversation about the play at all? Then, on Friday when he was presenting the details of *Playbill* he went on at some length about how surprised he was to see how well the class knew the *whole* play when interrogated by Professor Voelker, the outside evaluator.

It would be foolish to draw any general conclusions from this little anecdote. But consider it in the light of the decisions Jackie D'Aiutolo made when, building on Sheridan's and Bender's experience, she used *Playbill* in her own way. She simply refused many of the resources the technology offered her. The ones she used were the ones which served her self-proclaimed inclination to be very "structured," "linear," and "conventional" in her approach to *Macbeth*. The wisdom of her decision is especially apparent in light of the fact that *Playbill* was unique among the Tishman projects in that it was a 6 week sequence in an otherwise traditional course which newly grade-conscious sophomores were required to take. It is also significant that Jackie D'Aiutolo is now, after her initial experience, feeling inclined to try out some of the more open-ended possibilities of *Playbill*,and Bender has put *Oedipus Rex* on-line and is modifying his assignments into more tightly defined stages. The lesson of the combined experience of Sheridan, Bender and D'Aiutolo applies generally and may be framed as perhaps the most significant principle of all.

The principle which applies to student projects applies also to faculty projects, to all our projects:

8) You are in charge of the technology, not the other way around. Use what makes sense to you at any given stage in the development process.

Note: There is no denying that student projects diverge in a hypermedia environment, and many would say that the Dalton Plan calls for just such individualization. But it is worth noticing that a new sort of common ground may be emerging in the Tishman environments, and the original sense of the word "lab" (before it meant "free period" to students) describes it well. Everyone in

Tishman projects could and did participate intensely in discussions of the pedagogy. What they had in common and cared about and discussed endlessly was the course itself, the process of teaching and learning, the assignments, the resources and the best ways to use them, etc. And that was, of course, the heart of the Laboratory concept from the beginning.

What Parkhurst first realized we can construe as a final principle:

9) What we really and most immediately and meaningfully have in common in the school is not the canon but — the school.

Aphorisms

Here are some incidental observations, randomly arrayed and phrased as imperatives. They don't qualify as principles but may nevertheless repay some consideration:

1) Memorialize the happy accident.
When Monica Edinger first saw the Tandy word-processors she was given to use in her Fourth Grade writing project, she felt deprived. Their functionality was so limited, no fancy font or style options, no exciting graphics, just basic cut and paste word processing with an eight line display capacity. But, lo and behold, just those limitations led directly to enhanced performance in basic writing skills in her class because of the absence of distractions. The technology was perfectly balanced, not too much and not too little. Happy accidents, memorialized, might become principles. This particular accident is closely related to the principle which says you don't have to use all the resources at once, just because they are there. We want to memorialize happy accidents because, if enough of the same kind happen in enough different situations, they form the basis of a principle

2) Time and Space constraints are fundamental and systemic — and they can only be overcome through systematic reform.
Short of such reform, we will have to improvise, as Malcolm Thompson did when he replaced scheduled classes with labs (in the Parkhurst sense), held sessions on weekends and over pizza in the evenings etc. *Civil War CD-ROM* did the same thing, but

with eight students, not thirty eight! What is most striking here is that the "grid"-lock dominates the high school and gradually loosens its grip in earlier grades. Settings more congenial to the original Dalton Plan are to be found in the Middle School and, especially, in the First Program. That is why, for observers interested in the whole Tishman experiment as well as the particular projects it supports, nothing is more interesting than the bold innovations in scheduling underway in the Middle School for 1992-93.

3) Support your local Divisional Technology Coordinator.
Karen Bass in the First Program, Toby Sanders in the Middle School, Adam Seidman in the High School. The Tishman project has been in development *as it was being* implemented (see conclusion). Our resources have been limited, demands on time and space have been multiple, and we know that many members of the Dalton community feel as if they are not heard enough, not consulted enough, not included in judgments upon matters that bear upon the work they do. The New Lab reorganization for 1992-93, especially the position of Divisional Technology Coordinator, is an attempt to respond structurally and systematically to such concerns.

4) Politics is not a dirty word if you believe in what you are doing.
No doubt there will still be time and space problems, communication glitches, unexplained delays in resource delivery, network eruptions, seemingly arbitrary administrative requirements etc. What needs to be understood is that none of this is a matter of bad faith. People need to make it happen the way they want it to happen. Lobby, put it in writing, make that timely phone call — but most of all, do what you can with what you've got and *make something happen*. It might take time but it will be noticed (ask Karen Bass).

5) Real learning never ends.
A *cliché*, to be sure, but in the context of the new technology under a resurrected Dalton Plan, it might take on specific meaning again. *Archaeotype's* sixth graders were as willing to conclude their inquiry with alternative hypotheses, supported equally by the same data, as were the *Civil War CD-ROM*

students to pass on to their successors a collective "work in progress." And every good teacher knows that a course, whether supported by technology or not, must grow or wither. Every year we want to be saying "This year, I'm going to try this..." Parkhurst's Laboratory concept is a recognition of this requirement on the level of the school as a whole. It is, most fundamentally, an attempt to institutionalize institutional change.

Conclusion

A few thoughts of my own, by way of concluding.

Back in 1983 when Frank Moretti and Neil Goldberg were burying pots and coins in a giant aquarium over in the First Program, and neither one of them had given a thought to computers, I remember Frank talking about how the process of discovery in that aquarium led each child to ask his or her own "compelling question." He saw his business as providing an environment in which children would ask and then pursue such questions. That was, of course, the beginning of *Archaeotype* and, in due course, of the whole New Lab/Tishman enterprise. That bit of history underlines the point that, here at Dalton if not at Whittle Communications, the technology only matters insofar as it serves the educational purpose, and that understanding and commitment is what distinguishes what we are doing from other experiments with technology in education.

Archaeotype has understandably exercised an enormous influence on us all. On the development of *Ecotype* and *Dinotype* most obviously, but, in subtler ways, on all the projects. Don Nix, head of educational research at IBM, a Dalton parent and informal advisor to Tishman projects at the First Program, demonstrated dramatically how a great success can limit experimentation when he proposed a variation of *Dinotype* that would take it out of the "dig" context and place it in a "curator" context. It seems to me that what really makes *Archaeotype* work is not the simulated dig or even the game-like character, except insofar as the quality of serious play means that *Archaeotype* provides a compelling quest(ion) that carries students through a whole range of activities that the curriculum calls for. If that's right, then what the technology has to offer that the text-based classroom doesn't must be something like this: more opportunities for more kids to internalize more compelling questions in more subjects.

If we started from that simple premise, what would we look for, and how, when we considered all the subject areas and grade levels in the curriculum? Only the teachers involved in those areas and levels can really answer that question because it boils down to many questions taking on this form: what, in fact, *are* the compelling questions in the various fields and how can the technology be deployed so as to elicit them? That formulation binds students and teachers at all levels to scholars in all disciplines and places all of us, as educators, in a single community of inquiry.

Is there is something about education *per se* which makes it an especially suitable arena for the simultaneous exercise of theory and practice? I believe so. In education we are, by definition, not only doing but also learning. In education, success just is the constant interplay of theory with practice. If the New Lab at Dalton can bring the Tishman resources to bear on what Dalton already does so well, we can contribute to the future of education and serve the educational needs of our children at one and the same time. There is a commitment worthy of a progressive educational institution.

* * *

4) Staff Responsibilities

Redefinition of Staff Positions for 1992-93

Our procedure for staff evaluation was, first, to have Dr. de Zengotita conduct a confidential interview with each staff member. The outcome of that discussion was a self-evaluation by the staff member -- a document which included suggestions for general reorganization, as well as for his or her own work. Professor McClintock and Mr. Chou then used that document as the basis for a meeting with each staff member, during which mutual concerns were more formally discussed. Final decisions about staffing were made in meetings of the co-directors and implemented through discussions of each staff member with Dr. Moretti.

Through this process, we learned much about defining our staff needs and deploying our human resources. Our analysis of our experience over 1991-92 led us to identify the following requirements for New Lab staff to meet in the coming year:

1) apportioning a certain amount of functionality to overall infrastructural needs -- the network, the various concentrations and configurations of multimedia resources throughout the school, generally available software etc.
2) ensuring adequate technical support for the general user in the school, for students, faculty and administrators.
3) ensuring a clear and consistent flow of information between Tishman staff and the constituencies of the school.
4) ensuring that faculty and students who are seriously invested in particular Tishman projects have the hard and software support they need.
5) ensuring that faculty and students who are seriously invested in particular Tishman projects have the sustained attention of qualified design associates.
6) providing for the inception and development of new projects, and for the eventual integration of all the technical resources of the school.

In response to this set of needs, we created the position of Divisional Technology Coordinator for each Division of the school.

Functions 2) and 3) are thereby formally addressed and other personnel are better able to focus on other needs, as outlined in the individual job descriptions which follow.

Divisional Technology Coordinator -- First Program
Karen Bass

Ms. Bass was not formally associated with the Tishman Project in 1991-92, and so she was not part of the personnel evaluation process at the end of that year. However, she had functioned effectively as a Middle School computer instructor from 1987 to 1991, and, with the support of some New Lab staff and the growing Tishman infrastructure at the First Program, she developed an extensive multimedia module for her third graders in 1991-92. A number of us attended a presentation of her curriculum in April of 1992, and we came away convinced that Ms. Bass had intuitively grasped and applied some of the basic principles of the New Lab pedagogy. In her classroom, the computer was a resource which opened out into the world of the school and the city, not a video-game with some scholastic content.

We were also very impressed with Ms. Bass' persistence, on the one hand, and her patience on the other. She pushed us hard and long for what she needed, but, in spite of inevitable delay and frustration, she never lost her professional poise. Ms. Bass has earned a shot at the key technology position in her division, and we look forward to supporting her as she further develops and consolidates the Tishman enterprise in the First Program.

Ms. Bass' principal responsibilities include:

1) Overall responsibility for coordination of Tishman Project efforts to integrate computer resources into the educational work of the First Program.
2) Supervise Design Associates in their work with faculty on the development of pedagogy and curricula consistent with the aims of the Tishman Project and the Dalton School.
3) Continue to develop and implement the Computer Competency Curriculum in the context of technology-based classrooms, as agreed by the Headmaster's cabinet.

4) Provide and supervise others in providing instruction to teachers and students in the use of the First Program network and its resources, particularly those serving the educational goals of the Tishman Project.
5) Ensure routine upkeep and maintenance of First Program computer facilities, where appropriate.
6) Act as a conduit for all maintenance requests to the Tishman Project from the First Program

Design Associate
Eileen Gumport

As Ms. Bass has moved to take up her new responsibilities, Ms. Gumport has been working closely and effectively with her. We believe that, with direction thus provided, Ms. Gumport will contribute significantly to the First Program.

Ms. Gumport's responsibilities are:

1) Work with the First Program faculty and students, and with the Technical Coordinator and Design Associates, to integrate Tishman Project resources into the educational work of the First Program.
2) Work to develop new curricula consistent with the aims of the project in the context of these resources.

Divisional Technology Coordinator -- Middle School
Toby Sanders

Ms. Sanders was the obvious candidate for a position her arguments helped us to define. Our only question was whether she was mature enough to understand that frustration was to some extent inevitable, that things could not always go her way, that her job was to push hard for what she needed and then make the best of what she got. We discussed this aspect of the new job with her last Spring and worked with her closely for the balance of the year. Ms. Sanders grew remarkably into the role; she has remained firm in her advocacy, but she was also increasingly sensitive to the fact that in any complex enterprise there are competing needs. We expect her to continue to grow and contribute -- especially in the Middle School where she will have the support of a technically competent

Director who has made serious accommodations in Division policy to take advantage of the opportunities afforded by the Tishman grant.

Ms. Sanders' responsibilities are:

1) Coordinate Tishman Project efforts to integrate computer resources into the educational work of the Middle School.
2) Supervise Technicians in planning use of hardware and software to develop pedagogy and curricula consistent with the aims of the Tishman Project and the Dalton School.
3) Continue to develop and implement the Computer Competency Curriculum in the context of technology-based classrooms, as agreed by the Headmaster's cabinet.
4) Provide instruction to teachers and students in the use of the 89th St. building network and its resources, particularly those serving the educational goals of the Tishman Project.
5) Supervise routine upkeep and maintenance of Middle School computer facilities, where appropriate.
6) Request, in a timely manner and where appropriate, the Technical Support Coordinator to provide equipment maintenance at the Middle School and for any special needs that might arise.

Divisional Technology Coordinator -- High School
Adam Seidman

In his self-evaluation Mr. Seidman expressed frustration over what he saw as unrealistic deadline pressure on the development side of the *Playbill* project and communication problems within the New Lab and between the New Lab and the school as a whole. He also felt unsatisfied with his teaching, because he was working with what he sees as the old-fashioned "computer course" model, and because he felt he didn't have enough time to do it really right. Mr. Seidman felt fragmented. In certain ways, he embodied the twin imperatives which define the mission of the Tishman grant, but he experienced them as conflicting pressures and felt he was not doing his best work when coping with them. On the other hand, he took great satisfaction in helping individuals in the school with their technology needs; he has been a prodigious worker, ever generous with his time and attention. We hope and expect that his new position will provide the stability of purpose and consistency of expectation that Mr. Seidman needs in order to fully realize his best qualities.

Mr. Seidman's responsibilities are:

1) Coordinate Tishman Project efforts to integrate computer resources into the educational work of the High School.
2) Supervise Technicians in planning use of hardware and software to develop pedagogy and curricula consistent with the aims of the Tishman Project and the Dalton School.
3) Continue to develop and implement the Computer Competency Curriculum in the context of technology-based classrooms, as agreed by the Headmaster's cabinet.
4) Provide instruction to teachers and students in the use of the High School network and its resources, particularly those serving the educational goals of the Tishman Project.
5) Supervise routine upkeep and maintenance of High School computer facilities, where appropriate.
6) Act as a conduit for all maintenance requests to the Tishman Project from the High School.

Programmer
Bill Waldman

Mr. Waldman's responsibilities are essentially unchanged. They include:

1) Develop software on selected Tishman projects with particular responsibility for *Archaeotype* and the *Civil War Project.*
2) Collaborate in the design of the Multimedia Notebook and network navigation resources.
3) Help to define network needs, particularly with respect to optimal use of Macs over the network.
4) As appropriate, and in conjunction with the Divisional Technology Coordinators, help students, faculty and staff to make creative use of HyperCard and similar programs for the purpose of furthering the aims of the Tishman Project.

Network Manager & Senior Design Associate

Bob Matsuoka

Mr. Matsuoka's recommendations and requests to the executive committee converged happily with developments in the areas of hardware maintenance and purchasing, and the position of Network Support Technician was duly created (see below). That freed up a good deal of Mr. Matsuoka's time and gave us a way to respond to Malcolm Thompson's persistent requests for more (and more) computer expertise, while at the same time giving Mr. Matsuoka a chance to exercise his outstanding abilities in the classroom context. Mr. Matsuoka strikes us as just the person to work effectively with a strong personality like Mr. Thompson.

Mr. Matsuoka's responsibilities are:

1) Under the supervision of Luyen Chou and Robbie McClintock, state network policies and procedures and implement the expansion of network services, particularly with respect to adding CD-ROM services, dial-in and dial-out capacities, and ensuring that the core server resources are adequate to meet the educational and developmental goals of the Tishman Project.
2) Manage the implementation of a network for the First Program.
3) Ensure that the network being installed through the Institute for Learning Technology at Teachers College effectively mirrors network resources at the Dalton School so that its faculty and graduate students can contribute to the Tishman Project.
4) Train and consult with the Network Support Technician, in particular, and the Technical Support Coordinator and Divisional Technology Coordinators to enable them to keep the network functioning properly and continuously.
5) Work with Malcolm Thompson and the *Project Galileo* group to expand the resources and curricula of *Project Galileo* in keeping with the aims of the Tishman Project and the Dalton School; assist in integrating the computer science requirement into the Astronomy curriculum.
6) Collaborate in the design of the Multimedia Notebook and network navigation resources.

Technical Support Coordinator
George Mosler

Mr. Mosler has been relieved of his purchasing responsibilities and transferred to a new location from which he can organize his support activities free of distraction. The Technology Coordinators now have full time responsibility for technical assistance to users of the new technology.

Mr. Mosler's new responsibilities are:

1) Ensure the proper functioning of the Dalton/New Lab technological resources and infrastructure.
2) Assess maintenance and repair needs; respond in a timely fashion to requests for assistance from Divisional Technology Coordinators and New Lab staff; where appropriate, coordinate and track outside service orders.
3) Provide technical needs for special events and demos.
4) Under the supervision of the Divisional Technology Coordinators, provide for routine back-up and maintenance of workstations.

Network Support Technician
Wolfgang Heidmann

Mr. Heidmann came to us this summer out of the blue, a chance acquaintance needing a few weeks of work to help him along with his graduate studies. It turns out that Mr. Heidmann is a first class technician with a great store of skill and knowledge of just the kind we most urgently need in this crucial position. What is more, Mr. Heidmann has shown himself to be both aggressive and tactful. He took over the job, in the best sense of that phrase. We expect to rely on him increasingly in the future.

Mr. Heidmann's responsibilities are:

1) Place and track purchase orders, finding the best prices and informing the appropriate staff of the arrival of the material.
2) Develop and maintain invoice data base.
3) Track location of manuals and other technology-related materials, warrantees and licensing agreements.

4) Routinely install software and maintain accounts on the network.
5) See, on a daily basis, that the network is functioning soundly in the delivery of software to the workstations, management of print services, and storage of user files.
6) Oversee routine server back-up in accordance with procedures and schedule defined by the Network Manager & Senior Design Associate.
7) Assist in installation of new network resources in conjunction with the Network Manager & Senior Design Associate.

* * *

5) Collaborations and Contributions

Collaborations, or Not Reinventing the Wheel

Institute for Learning Technologies – Teachers College, Columbia University

Robert McClintock, Director of the Institute for Learning Technologies, and Frank Moretti, Director of the New Lab, have collaborated on technology projects since the mid 1980s. In 1990, they together developed "The Cumulative Curriculum Project," a large-scale proposal for using multimedia in transforming the school curriculum. The conceptual foundations for the Tishman Project derive from this proposal. Even earlier, an ILT programmer, Steve Taylor, worked with McClintock and Moretti through NLTL on the early versions of *Playbill* and *Archaeotype*.

Several current staff members of the Project come to it through ILT and the Department of Communication, Computing, and Technology in Education at Teachers College, in particular Bob Matsuoka, the Dalton School Network Manager, and Toby Sanders, Middle School Technology Coordinator. ILT runs a Multimedia Design and Development Lab in which advanced implementations of networked multimedia are being developed for testing at Dalton. This work will help the New Lab make use of high-speed wide-area-networks and develop a multimedia library of diverse digital resources to support the intellectual life of the school. During the 1992-93 school year, we will establish high-speed links between the network server in the ILT lab and the main server at Dalton.

Center for Telecommunications Research – Columbia University

The Institute for Learning Technologies and the New Lab are together a prospective test site for Project ACORN, a very high-speed networking project at the Center for Telecommunications Research. ACORN has extensive support from the National Science Foundation and from a coalition of major corporate sponsors. Schools with technology enriched curricula such as that we are developing at Dalton will be important users of very fast networks capable of sustaining numerous interactive multimedia exchanges simultaneously. ACORN will transmit information encoded in laser beams sent through fiber optic networks. The preliminary installations for our participating in these tests will be installed in the ILT development lab in 1993.

WNET/Channel 13

Good networked multimedia for educational uses thrives on collaborations between groups that previously seemed to be working in separate domains. This fact is the basis of an on-going collaboration with a multimedia development group at WNET under the direction of Hugh Osborn. Currently, we are jointly discussing with several software companies ways to manage very large multimedia databases. In addition we are exploring ways in which our pedagogical expertise can combine with their video production capacities to create effective educational programs more economically.

Harvard University/Perseus Project

The New Laboratory for Teaching and Learning has been a beta test site for Harvard University's Perseus Project for the past three years. Perseus, a multimedia database on Hellenic civilization which was recently released commercially by Yale University Press, includes a wealth of textual, pictorial and video resources. The CD-ROM based resource designed for use by scholars and university students allows users to view LANDSAT pictures and zoom in on portions of the classical Hellenic world, examine city plans, see reconstructions of ancient sites, and follow guided tours of selected ruins contained on an accompanying videodisc. Perseus also provides access to a wealth of primary texts (in original and translation), museum artifacts, and other scholarly materials. Since 1990, students and teachers working with *Archaeotype* in sixth grade social studies have used Perseus as a research database and provided the Perseus Project team with written reports on program bugs, design flaws, and content errors.

Cornell/Interactive Multimedia Group (IMG)

In consultation with Professor James Maas of Cornell University's Department of Psychology, the New Lab and the IMG have begun to discuss the formation of an on-line multimedia design colloquium that would link major educational technologies developers around the country via electronic mail. The colloquium would allow developers to share design ideas and implementation schemes, as well as to exchange prototypes of new software. The IMG, headed by Dr. Geri Gay, has developed several videodisc based educational resources used by students at Cornell. Of particular interest to the technical staff of the New Lab is the IMG's research into networked multimedia and the transmission of moving images over wide-area networks.

Letter to Dr. Gardner Dunnan — February 14, 1992

Dear Gardner:

I want to thank you for the opportunity to witness first-hand the work in progress at the New Laboratory for Teaching and Learning. I have been studying instructional technology for more than twenty years and have visited centers and laboratories throughout the United States and Europe. Rarely, if ever, have I seen a comparable program that so well integrates curriculum design, technology and evaluation, while at the same time being sensitive to the formidable task of faculty acceptance.

Rather than take an isolated approach by involving a single topic within a discipline, or utilizing one technology-minded teacher and a handful of students, you have chosen a much more ambitious, difficult and wise path. The programs I saw have a marvelous interdisciplinary nature. And, they obviously have captured the imagination of some "traditional" teachers who are just getting acquainted with the pedagogical potential of interactive multimedia education. The project managers are not only extremely competent in their own disciplines, but seem to be fully aware of the many ramifications (and unresolved issues) involved in integrating technology into the curriculum. The utilization of a team approach and the participation of outside program and evaluation consultants is most laudatory and will produce valid qualitative and quantitative assessments of student learning.

Aside from the staff, the equipment resources, and the enthusiastic students, what is most gratifying (and, unfortunately, novel) to see is the emphasis on discovery learning. So much of the software in computer-based education uses software & hardware simply as an expensive electronic dictionary. The interdisciplinary and challenging *Archaeotype* program, if typical of the rest of your projects, will provide a revolutionary breakthrough in middle school education.

The only aspect of your program for which I can offer some constructive criticism is that of software dissemination. For your own students it would be nice to have the possibility of modem links between home and school, or at least software packages that could be used at home. But the more serious issue is that of packaging and disseminating your incredible programs for use in other schools. It would be a tremendous waste of resources if the Dalton materials were restricted to the Dalton environment. You are developing a gold mine of educational software; share the richness of your curriculum with the rest of the nation! I realize that this is beyond the scope of your present mission and resources, but for the sake of students and teachers everywhere, the issue should be addressed. And keep us all posted on the trials and tribulations involved in convincing "traditional" faculty to author and/or adopt your innovative ideas and programs. If you are not already doing so, it would be great to consider producing a videotape on all aspects of the project to disseminate to other schools. As such presentations are in my own area of expertise, I would be happy to give you whatever counsel you might find useful.

The multimedia lab at Cornell, with the assistance of IBM, is developing university programs in such areas as language instruction, environmental studies, entomology, collaborative engineering design, myth-making and visual literacy. Our computer graphics center, working on rendering and perspective in fields ranging from architecture to medicine is among the foremost in the world. Although I am not sure how much we could enhance your excellent work, I think that it would be of value to have some of your project managers spend a day with us in Ithaca. I would be happy to make the arrangements.

Again, thanks for the opportunity to become acquainted with your school. Mr. Tishman has every right to be thrilled with the project he has so graciously funded; I am convinced its potential is of a magnitude well beyond his expectations and your current mandate.

Cordially,

James B. Maas, Ph.D.
Professor of Psychology
Director, Psychology Film Unit

Apple Computer

Following several visits by Javier Villalobos, manager of ESL, Bilingual, and Literacy Solutions for Apple's K-12 Marketing division, the New Lab was contacted by several groups at Apple about collaboration in beta test programs. The New Lab is currently a test site for Apple's new system software and its "world script" extension which provides the Macintosh with foreign language capabilities. Other beta collaborations planned or currently underway involve QuickTime digital video software, HyperCard, and AppleScript. Apple also plans to feature the work of the New Lab at the Dalton School in its initiative to help schools plan for technology integration. Most notably, the New Lab and the Dalton School will be featured this fall in two Apple "Success Stories" on educational computing and on educational uses of digital video (QuickTime). A request has been sent to Apple for $1.6 million in equipment to make Dalton into an "Apple Academy" which would serve as a demonstration site for regional schools interested in exploring curricular uses of new technologies. The New Lab has been instrumental in revitalizing Apple's interest in private school initiatives in technology and education.

Letter to Mr. Luyen Chou — July 15, 1992

Dear Luyen:

I wanted to take a minute to extend my appreciation for hosting me at Dalton's New Laboratory for Teaching and Learning this April 1, 1992. I hope you concur when I say that I truly enjoyed meeting you and your staff while visiting New York City. I am specially grateful that you were able to take the time out a very tight schedule to share with Apple the wonderful projects that are underway at the Dalton School. I am certain this is the beginning of a number of visits by Apple and perhaps the start of some truly exciting collaborations.

On my return to Cupertino, I have shared the excitement of my visit with a number of people at Apple. In particular, I spent time with our director of K-12 Marketing, Dr. Randy Pennington, who is excited to hear about the unique multimedia projects at your school. He will be in New York soon and will contact you for a visitation.

Your school certainly stands out among the many technology sites I have visited over the years. I was impressed with the commitment the school has to empower students with the latest technologies along with the most innovative approaches to teaching & learning. Your *Playbill* and *Archaeotype* interactive multimedia projects are exemplary in the use of Macintosh to teach English and Archaeology using cooperative and interdisciplinary strategies. While the research has been out for many years about these methods, it has been rare to find good examples that utilize technology.

My hope is I will be able to assist you in gaining additional recognition through the Apple's communication channels. In fact, our worldwide multimedia group has alerted me that they are considering your school for some new collateral they are in the process of producing.

Pursuant to our conversations, I am sending you a variety of software demos along with some of Apple's Multimedia Design Example videos. These were research collaboration projects started back in 1986 much like the ones you have been designing at Dalton. Apple entered into these collaborations to obtain important research findings about the ways to design the human interface of the multimedia tools. Many of these early collaborations are now products such as GTV, *Animal Pathfinders*, *Visual Almanac*, *Point of* View, etc. I wanted you to have these so that you could share with your staff some of the early work in multimedia design. Maybe these will be helpful in the future as you begin new projects.

In closing, I want to let you know that I will be in contacting you before my next trip this fall. There may be some potential ways to have you and your staff involved in some of the testing, prototyping or beta testing if you are interested. In the meantime, if this is anything we can be of assistance, please do not hesitate to call.

I enjoyed my visit to Dalton tremendously and I am looking forward to visiting once again this summer.

Javier Villalobos

Manager, ESI, Bilingual & Literacy
Apple K-12 Education

DiVA

Last fall, the New Lab became a beta test site for The DiVA Corporation's VideoShop software, a revolutionary desktop video editing tool based on Apple's new QuickTime technology. With the help of DiVA's staff, Dalton became one of the first schools in the country to use VideoShop to make digital movies in its courses, and the only site to engage in networked storage and playback of QuickTime video. The Civil War class used VideoShop to store selected clips of Professor James Shenton's walking tour of New York City, interviews with teachers and students, and to construct video documentaries on Civil War history. VideoShop is also being used to update the Playbill software and eliminate its dependence on videodiscs. Next year, students in the Playbill class will be able to store performances of their own interpretations of scenes from *Macbeth* on the network. This fall, DiVA's staff will be conducting workshops in digital video at The Dalton School. DiVA, increasingly interested as a result of these early experiments in educational applications, is seeking ways to disseminate the New Lab's successful use of digital video in the classroom. Student work is already being featured at DiVA's conference exhibits and in their promotional materials, plans have been made to develop future educational products in collaboration with the New Lab.

Letter to Mr. Luyen Chou August 14, 1992

Dear Luyen:

As a previous Daltonian from the class of 1982, and a current member of the multimedia community, I am thrilled to see the astonishing work in place at The Dalton School. I am pleased and honored to offer a donation to Dalton of a $150,000 package of products and services.

Currently, I am the President of DiVA Corporation, a Cambridge-based software company that develops and markets digital video software applications. Based on work at the Interactive Cinema Group at The Media Lab at MIT, my partner and I founded DiVA in 1990. DiVA's mission is to create tools which allow people to work with video on a computer in the same way that people today are able to work with text, numbers, and graphics. As a development partner with Apple Computer, DiVA worked closely on the development and introduction of QuickTime, Apple's new system software which is revolutionizing the computer industry by enabling users to work with digital video on the desktop. DiVA VideoShop, our recent product announcement, allows computer users to create and edit digital movies of their own. Though we anticipated strong markets, never did we expect such excitement and interest from the educational community.

Applying multimedia to education is deep rooted in DiVA's history. Early work in 1990 with The Harvard School of Business (PMD Program), involved developing multimedia case studies for teaching management principles to senior executives. Through this experience, I have come to understand the power and importance of integrating technology, pedagogy, and content. It is with great pleasure and amazement that I see similar trends, teaching patterns, and care for the learning experience taking place at Dalton.

When we established Dalton as a software test site for DiVA VideoShop in late 1991, I never imagined that such success, creativity, and innovation would have resulted. We have been working with schools, businesses, developers, and creative thinkers around the globe who are looking into the issues of multimedia. I can honestly say that the work and academic thought at my alma mater matches any in the world.

The *Civil War Project* is a stellar example of how technology can be used to empower the student to take control of her own learning experience. There is no doubt that the students involved will remember this project for the rest of their lives. They were obviously engrossed both by the subject matter, and by the discovery of the power that they contain within them to express a compelling message.

Playbill shows how digital movies can create a richer learning environment in which students can explore and analyze a topic in ways that can not be done in mono-media. *Archaeotype* and *Project Galileo* are fantastic examples of how the computer can be used to create and offer content specific tools which provide meaningful exploration to the student. I look forward to working with Dalton to explore further ways in which curriculum like this can be enhanced with digital movies.

To reward and promote the continuation of excellence at Dalton's New Lab for Technology and Learning, DiVA would like to donate a site license for 1,200 units of DiVA VideoShop to cover the entire Dalton School. I also look forward to spending more of my time personally to work with you, the students, and the rest of the group as you pioneer a new course for the future of education.

Luyen, I wish you and Dalton my heartfelt congratulations and best wishes. The New Lab is an example for the rest of the educational community, as well as the multimedia industry to marvel at and learn from. I am honored to be an alumnus of The Dalton School and to contribute to its ongoing mission.

Go forth unafraid,

Jonathan D. Harber '82

The New York Historical Society

In the fall of 1990, member's of Dalton's Civil War Project course became the first high school students to be granted access to the New York Historical Society's archives. As part of an on-going collaboration between the New Lab and NYHS, the society's staff has conducted tours of the collection, demonstrated preservation techniques, and consulted with the Civil War Project's participants on their research. The New Lab is continuing to seek ways to expand its role as a channel through which the Historical Society's collection can be made available in digital form to the educational community on CD ROM and via high-speed wide-area networking.

Columbia University

This past academic year, Professor James Shenton of Columbia University's Department of History joined the New Lab as a consultant to the Civil War Project. In addition to conducting a tour of New York City which was filmed and digitized by Dalton students, Professor Shenton made himself available to students as an advisor, and conducted several classes and seminars for the Dalton community on New York City and American history. This year Professor Shenton's undergraduate course entitled "The Historian's Craft" will be conducted in partnership with the Civil War Project at the Dalton School. Columbia students will collaborate with Dalton students on the expansion of the multimedia library on American History and the construction of multimedia history projects.

Professor John Russell of Columbia's Department of Art History and Archaeology has joined the *Archaeotype* team as a technical consultant to the construction of the Assyrian site that will be unveiled in October, 1992. The *Archaeotype* development team has made extensive use of Avery Library and has been provided with office space at Columbia where it is compiling material for the multimedia database on Assyrian history. As in the case of the Civil War Project, the Assyrian *Archaeotype* will be used at the university by undergraduate and graduate-students in Professor Russell's course on Assyria.

The Institute for Learning Sciences – Northwestern University

Roger Schank, the former and well known Director of the Artificial Intelligence of Yale University, has put together $150 million initial funding for the Institute with the intention of serving both industry and education. Dr. Schank's goal is to revolutionize education through the use of new technologies. Dr. Schank visited New York and the New Laboratory for Teaching and Learning, at which time he met with Frank Moretti, Robert McClintock and Luyen Chou and a number of the New Laboratory's Tishman Projects were demonstrated. Dr. Moretti returned the visit by going to the Institute for Learning Sciences and spending an entire day reviewing the software creations of Dr. Schank's associates. At the end of that session it was agreed that the Institute for Learning Sciences would enter into a collaboration with the New Laboratory for Teaching and Learning by providing whichever software packages most interested the New Laboratory so that they may be both tested and critiqued.

Letter to Dr. Frank Moretti August 17, 1992

Dear Frank:

Thank you for visiting the Institute for the Learning Sciences at Northwestern University last Tuesday, August 11. We so enjoyed learning about the efforts being made at the Dalton School and having the opportunity to share with you some of the educational projects currently underway at the Institute.

Please allow this letter to serve as clarification and documentation of your conversation with Roger Schank regarding the opportunity for the Dalton School to experiment with some of the Institute's prototype software:

1) The Institute for the Learning Sciences wishes to provide the Dalton School with a gratis license to work on various Institute software applications;
2) It is understood that the Dalton School will allow qualified representatives to work with the software tools and possibly enhance the current software;
3) All enhancements, changes, additions and/or deletions to the software will become the property of Northwest-

ern University and the Institute for the Learning Sciences;

4) All research and development work to be performed by the Dalton School must remain within the school; and
5) The Dalton School may utilize the Institute's software and its software tools in any way the School sees fit, but may not allow the applications to be shared with outside audiences.

Please acknowledge the above agreement by signing and dating the document and forwarding a copy back to my attention for our records. Again, Frank, many thanks for your interest and consideration. We are so looking forward to working with the Dalton School. If you have any questions or need additional information please feel free to contact me directly at (708)491-3710.

Very truly,

Laura Siff Reichert
Manager of External Relations

University of Pennsylvania – Interactive Language Instruction Program

Dr. Jack Abercrombie visited The Dalton School at the invitation of Drs. Steinlight and Moretti who had visited Dr. Abercrombie at his University of Pennsylvania Laboratory. Dr. Abercrombie has done cutting edge work in the use of interactive programs in language instruction that rely on the use of film as the data platform. We are presently field testing two of Dr. Abercrombie's projects and intend to be integrating them into both appropriate French and Spanish classes.

The Chula Vista School District

Chula Vista is a California School District four miles north of Mexico which has a uniquely American multi-cultural population of Mexicans, Asians, Blacks and Caucasians. We have entered into an agreement with the Chula Vista School District to allow them to field test *Archaeotype* at the Juarez Lincoln School. This collaboration is useful to the New Laboratory since it automatically creates a direct linkage with San Diego State School of Education which has a very positive link to PacBell, the local phone company. Our most immediate plans are to have two tele-conferences between the Juarez Lincoln students and teachers and the Dalton students and teachers who are doing *Archaeotype*. Our long term goal is to use this as a demonstration to generate support for our efforts to create broadband tele-conferencing capacities between Chula Vista and Dalton, as well as between Dalton and a number of other cultural and educational institutions, including both schools and museums and libraries.

Massachusetts Institute of Technology – MUSE Project

Through the efforts of Dr. Steinlight and Dr. Janet Murrary, Director of MIT's Athena Language-Learning Project and key foreign language person, Dalton will become a beta test site for the MUSE Interactive Video Project in both French and Spanish. MIT has agreed for a nominal price to provide faculty training in the use of these tools. The faculty training has begun this August with the visit of Dr. Giberte Furstenburg who worked with Dr. Steinlight on the pedagogy she has deployed with the use of *Philippe*. MIT is eager to see what use Dalton and the New Laboratory make at the school level of their projects developed for the university level. We are eager to proceed with our testing. Also in conjunction with MIT's MUSE Project, we have explored the possibility of collaborating on the design of an ecologically oriented program in conjunction with Professor James Noblitt, the Director of that project.

Paramount Inc.

Dr. Kathy Wilson, who has been a constant collaborator with Dalton's New Laboratory as the creator of *Palenque*, has become a key member of the strategic planning group of the Paramount Corporation. The intention of this group is to plot the future in regard to multimedia and electronic publishing. After an August meeting with Dr. Wilson, Dr. Moretti has begun planning a project, in which Dr. Wilson indicates Paramount would have great interest: the creation of a simulation that brings together both the features of *Archaeotype* and *Palenque.* These discussions are in their preliminary stages but are anticipated to be very positive with productive outcome.

The Educational Development Corporation

Dr. Median Kurland, the creator of the *Bankstreet Writer*, has met on three different occasions with Luyen Chou and Frank Moretti to discuss the deployment of his newest and most fascinating piece of software, "The Text Browser." We have agreed to proceed over the course of the next term with a proposal that would integrate the Text Browser into some of the Dalton projects as a toolfor assessing student achievements. It is hoped that the Text Browser will begin to address some of the assessment problems one encounters when one creates a constructivist learning environment and emphasizes collaborative endeavors. Dr. Wilson of Paramount Inc. is also eager to include the Text Browser as a dimension of the *Archaeotype/Palenque Project* discussed above.

Letter to Dr. Gardner Dunnan April 15, 1992

Dear Dr. Dunnan:

I am writing to extend my thanks to everyone in your impressive school for allowing me the opportunity to engage with the staff of the New Laboratory for Teaching and Learning. I work with many schools around the country and can state without reservation that The Dalton School is way out on the cutting edge in its application of technology to core aspects of the curriculum. What is unique about Dalton is the manner in which technology is used to support and enhance an already powerful curriculum. Too many schools (and too many software packages!) approach technology either as an adjunct to the "real" curriculum or as a replacement for it. In contrast, from what I observed, programs like *Playbill* and *Archaeotype* provide powerful models for how technology can support and extend a project-based, thematically organized curriculum.

At EDC we develop software, curriculums, and staff development models that are used in schools across the country and around the world. My particular focus at EDC is exploring ways computers can support teachers as they struggle with managing thematic, inquiry-based, curriculum units. For example, we are currently developing an integrated suite of tools that help teachers develop, carry out, and evaluate performance-based assessment techniques. One very real problem we face in doing this work is finding schools that have both a deep understanding of authentic assessment and a mature appreciation for how technologies of all types can support and enhance the learning process. We also rarely encounter a school with as thoughtful and effective an approach to staff development as was evidenced at Dalton. During my visit I was delighted to find a school where enthusiastic staff and students are so primed to exploit technology in powerful ways. The combination of your work in multimedia exploration and composition coupled with our work in tracking and evaluating electronic portfolios of student work could provide us with a unique opportunity to explore how excellent teachers can become even more effective facilitators of their students' learning.

During my visit, I met with Frank Moretti and his staff along with Kathy Wilson from Bank Street. Together we discussed possible ways in which Dalton, Bank Street, and EDC might collaborate in the future. Regardless of what transpires, (and I sincerely hope something does!) your school and its ground-breaking work in infusing technology throughout the curriculum, made possible by Mr. Tishman's generous grant, have certainly been an inspiration to me.

Sincerely,

Dr. D. Midian Kurland
Senior Scientist
Center for Learning, Teaching, and Technology
Education Development Center, Inc.

Dr. Donald Nix, IBM Research

Dalton has entered into a collaborative agreement with Dr. Don

Nix, Manager of Educational Research at IBM Research. Dr. Nix has set up two advanced multimedia work stations in Dalton's First Program and will be spending two mornings a week at the Dalton School working with teachers on the use of these systems. Dr. Nix's specific interest is in expressive learning, and he has created cutting edge prototype tools that give students, from the age of 7 on, the opportunity to create multimedia documents with facility. Dr. Nix has been a long-time associate of the New Laboratory for Teaching and Learning. In the late 1980s, he helped to pioneer the New Laboratory's efforts in technology by doing a demonstration project in the use of his own authoring language, *Handy*, with two groups, one of Dalton's seniors and one of Middle School students.

NYNEX Science and Technology

The New Laboratory for Teaching and Learning has presented its work, in conjunction with NYNEX's Science and Technology Division, to Vermont educators and state officials as examples of the educational potential of networked multimedia. We will soon present a proposal to NYNEX Science and Technology, seeking high-speed data links between the New Lab and Columbia, WNET, one or two public schools, and several cultural institutions like the New York Historical Society.

IBM Research – Interactive Media Program

IMP Builder is an experimental authoring resource for creating digital video programs quickly and simply. During the 1992-93 school year we will be testing its usefulness in allowing students to create an interactive video magazine covering the life and times of Dalton.

Rensselaer Polytechnic Institute

Dr. Jack Wilson, the Director for The Lois J. and Harlan E. Anderson Center for Innovation in Undergraduate Education, has entered into a collaborative agreement with The Dalton School so that Dalton can become a field site for testing his CUPLE Program. CUPLE is a tool that can be used either by teachers for demonstration purposes or by students for research purposes. It allows the deployment of a number of existing computer tools in interaction with a variety of video disk resources. Dr. Wilson's most telling example is the use of the disk on the Tacoma Narrows Bridge in the deployment of superimposed plotting devices as well as spread sheets both of which the user can manipulate. Dr. Wilson will be visiting The Dalton School in the 1992-93 academic year, as he did in 1991-92, to work with students and teachers on the use of CUPLE.

Metropolitan Museum of Art

Over the past two years Dr. Kent Lydecker, the Director of Education for the Metropolitan Museum of Art, has met with members of the New Laboratory of Teaching and Learning to explore possible collaborations in the areas of multimedia curriculum and multimedia presentation. In Dalton's effort to create a working relationship with NYNEX, we anticipate that the Metropolitan Museum of Art will be a key participant. We are presently exploring further connections that might be effected through the establishment of a common employee who would provide linkage between the Metropolitan Museum and Dalton.

Bank Street School of Education –
The Center for Children and Technology

Over the past two years, under the direction of Kathy Wilson and Jan Hawkins, the Dalton School has enjoyed a useful collaboration with Bank Street. As part of a large federally funded study, they have dedicated significant resources to evaluation of *Archaeotype* and, more broadly, to the development process the New Laboratory has used in various technology-based curriculum areas. The future of Dalton's collaboration with Bank Street is bright. Presently, Dr. Moretti and Dr. McClintock are talking with the Center's leadership to shape a proposal directed at the question of assessment in new innovative programs which are technology based. At the same time, evaluations sponsored by the Federal Government which Bank Street has done in the past are continuing apace.

Mount Wilson Observatory, Pasadena, California

The New Laboratory for Teaching and Learning has established a strong relationship with the Mt. Wilson Observatory to create links from their 60-inch astronomical telescope and solar telescope directly to Dalton. The effort is part of a pilot program to eventually build an automated telescope on the mountain for national school use. The Galileo Project manager sits on the Mount Wilson Educational Advisory Board and is a principal in a Mt. Wilson $200,000 proposal to NYNEX and to the DOE.

Harvard-Smithsonian Astrophysical Center

The New Laboratory for Teaching and Learning has a close working relationship with staff astronomers at HSAC. Through the Center, a small NASA grant ($4K) has been obtained for the development of materials. HSAC is a rich source of advice, guidance and information for the project.

National Oceanographic and Atmospheric Administration

We are currently linked to NOAA by the Internet to acquire daily solar images from them. They maintain a collection of images from six western observatories on a computer to which we have access.

Camp Sloane, Lakeville, Connecticut

We are currently investigating the Camp Sloane campus as a possible site for archaeological, ecological and astronomical field programs during the school year and in extended school year programs. The camp has shown a strong interest in collaborating with NLTL in the development of such programs.

* * *

Mode ◆

Title Goals

Author Chlöe and Emily

Text

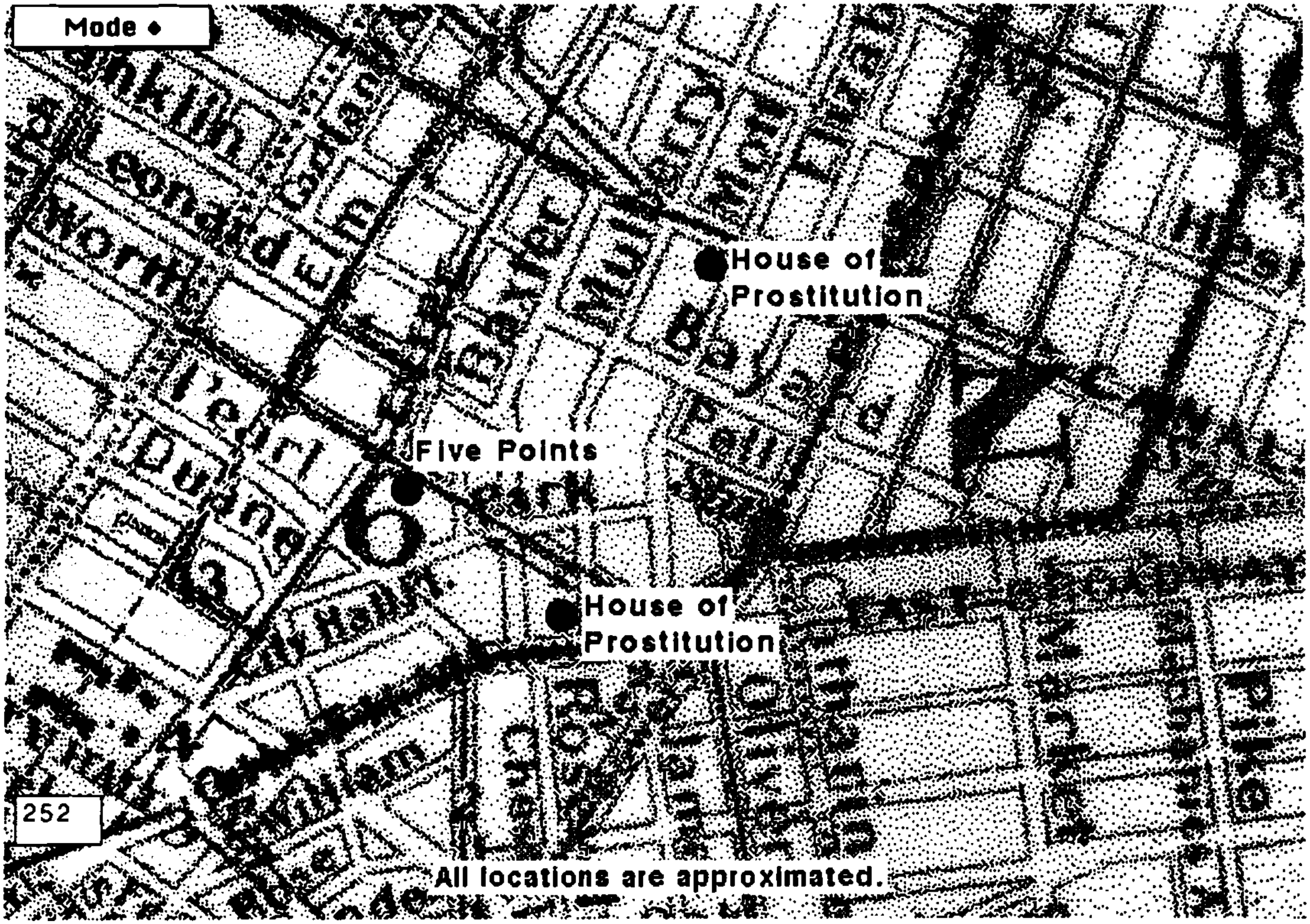
Create a Notebook

Go to Gerda Lerner

Goals

Through this project we hope to help the user achieve a better understanding of Women's History and its role in education. By way of our research, we hope to help dispell the myth that Women's History does not exist, or that it is not important. We have found that across the three classes, economics, culture, and politics appeared as the three dominant catagories. Analysis is also a catagory that we have included since the nature of history and historiography raises other historians' analysis. You will find the catagory of the text you are reading in the upper right hand corner of the text field (quite often it will be a combination of the four catagories). Please use this feature as a guide so that you may keep track of all the information you will be exploring.

The introduction is designed to open the user's mind to different perspectives on Women's History, ones that will hopefully cause them to re-evaluate or review their past attitudes and shape new ones. We have included the recent Association of American Universities for Women (A.A.U.W) Report, "How Schools Shortchange Girls," because we feel that Women's History plays a crucial role in a girl's education: "the formal curriculum is the central message-giving instrument of the school. It creates images of self and the world for all students..." The significant lack or trivialization of Women's History in present curriculums ("...in 1971 a study of thirteen popular U.S. history textbooks revealed that material on women comprised no more than 1 percent of any text, and that women's lives were trivialized, distorted, or omitted altogether..."), is an important issue, one that must be remedied. This can only be achieved by a substantial shift in attitudes towards Women's History. "Women in the New York City Draft Riots" hopes to help begin this process.



Mode ◆
House of Prostitution
Five Points
House of Prostitution
252
All locations are approximated.

6) Expenditures and Inventories

Compared to many projects devoted to technology in education, our expenditures for salaries are relatively high. People, neither hardware nor software, are the essential elements in both technology and education.

For an effort such as the Tishman Project to succeed, people need to take risks. In particular, teachers need to rethink in disconcerting ways how they will go about their work. To do that, teachers need some reward and much support. To a modest degree, the reward has been monetary, raising slightly through percentage overages and stipends what participating teachers earn. More significantly, we suspect, the reward arises from intangibles -- a sense of renewal, engagement, adventure, and accomplishment. Teaching with technology changes the profession in ways that may make it more bracing and satisfying.

Where teachers take the risk to restructure what they do and how they work, they need also much support. Essentially, our expenditures for staff, equipment, and materials serve this function. Our means are substantial but limited. The limiting factors on support, however, are not primarily monetary. Scheduling inertias make it difficult to keep equipment that has been installed at its maximum potential use. In our first year, many staff members had to concentrate on installing and stabilizing new systems, with less time than would have been optimum for providing support to users. The mix of staff time in our second year should shift perceptibly to giving teachers and students more support in their work than was the case in our first.

Information technologies are rapidly evolving. Consequently, at this juncture, the human resources of the school are far more stable than the technical. As soon as we install equipment, it begins to become obsolete. Teachers, in contrast, like their students, develop and grow in depth and ability. The most important infrastructure that we have to build is one of developing know-how and commitment. The best expenditure for equipment and materials is one that enables teachers and students to accomplish as much as they can, while whetting their appetites to move on to more challenging possibilities.

Expenditures for 1991-1992				
	Budgeted	Committed	Remaining	%
Total Expenditures	**$1,009,750**	**$1,010,737**	**($987)**	**-0.1%**
Total People	**$512,550**	**$475,659**	**$36,891**	**7.2%**
Total Equipment	**$360,000**	**$435,571**	**($75,571)**	**-21.0%**
Workstations & Accessories:		$285,518		
Network Installation & Parts:		$104,004		
Classroom Displays, etc.:		$14,553		
Peripherals (Printers, Scanners, etc.):		$31,496		
Total Materials	**$118,000**	**$79,403**	**$38,597**	**32.7%**
Space Renovations:		$34,431		
Software:		$32,494		
Video Supplies, etc.:		$2,763		
Other & Miscellaneous:		$9,715		
Total Other	**$19,200**	**$20,104**	**($904)**	**-4.7%**

Our budget planning for 1992-93 increases the amount spent on people, reflecting increases both in faculty commitment and in support staff. In most areas, Equipment and Materials will be roughly the same as during the first year, except that expenditures for workstations and accessories, network installation and parts, and space renovations should decline somewhat. Our main change with respect to our equipment environment is a matter of policy, not expenditure. Our original intent was to create a "dual-platform" computing environment, relying equally on *Macintosh* and *MS-DOS/Windows* systems. For the near future we have given up on this aspiration, as it leads, over the short-term, to both development and support difficulties.

As a result, we plan for 1992-93 to purchase primarily

Macintosh hardware, peripherals, and software. Instead of a dual-platform environment, we will be a *Macintosh* environment, with *MS-DOS* systems for computer science and mathematics and for occasional niche-programs across the curriculum. Should concrete interest in *MS-DOS/Windows* resources spread, then it may prove feasible in one or two years to return to the dual-platform strategy. Currently our staff is not sufficiently ambidextrous technically to support creative development simultaneously in both environments, and most participating faculty members have a decided preference for Macs. While Macs are distinctly more expensive on a price/performance basis, the project will progress further over the next year or two by concentrating on the Macintosh.

Here is our budget for the coming year:

Estimated Expenditures for 1992-1993	Spent 1991-1992	Budgeted 1992-1993
Estimated Total	**$1,010,737**	**$1,007,094**
Projected people	**$475,659**	**$557,599**
Total equipment	**$435,571**	**$361,495**
Workstations & Accessories:	$285,518	$251,495
Network Installation & Parts:	$104,004	$65,000
Classroom Displays, etc.:	$14,553	$15,000
Peripherals (Printers, Scanners, etc.):	$31,496	$30,000
Total materials	**$79,403**	**$68,000**
Space Renovations:	$34,431	$25,000
Software:	$32,494	$30,000
Video Supplies, etc.:	$2,763	$3,000
Other & Miscellaneous:	$9,715	$10,000
Total other	**$20,104**	**$20,000**

Looking beyond the coming year for planning purposes, we have made two prospective budgets. Our current support from the Phyllis and Robert Tishman Family Fund runs through the 1992-1993 year. Our first, minimal budget addresses the contingency that such funding will stop. What will it cost to keep the project functioning? Our second, optimal budget reflects the fact that integrating technology into a school such as Dalton is a long-term effort. At the end of the coming year, we will have made a significant beginning, but much will remain to be done. What level of expenditures would optimally extend the initiatives we have commenced?

Our minimum budget is essentially a maintenance budget. We assume that creative work on existing projects will stop, but use of existing resources will continue. As a result we anticipate a radical reduction in staffing, keeping only three positions -- the Associate Director of the New Lab, the Manager of the Dalton Network, and the Equipment Maintenance Technician. The amounts estimated for Equipment and Materials represent 15% of the amounts spent in these lines for 1991-92 and 1992-93. Such a percentage is a reasonable allocation, providing for good maintenance but only very slow replacement.

Our optimum budget would extend creative work on the project at a slightly higher level compared to our initial two years. We have projected a 10% increase relative to our 1992-93 budged for faculty and staff. This would provide for a modest expansion of faculty involvement and the addition of one more programmer/designer at an entry level salary. We expect several new project areas to be opening up -- in music, chemistry, and student assessment. Additionally we expect the scale of work in our First Program and Middle School initiatives to increase. We have estimated the Equipment and Materials costs by adding our allocations for maintenance in the Minimal 1993-94 budget to the largest amount spent in each area for 1991-92 or 1992-93. This would seem to provide for solidification of past initiatives and further extension of the technical infrastructure at a pace slightly above the current one.

Estimated Expenditures for 1993-1994

	Budgeted 1992-93	Minimum 1993-94	Optimum 1993-94
Estimated Total	**$1,007,094**	**$278,713**	**$1,288,015**
Projected people	**$557,599**	**$140,000**	**$613,359**
Total equipment	**$361,495**	**$119,560**	**$555,578**
Workstations & Accessories:	$251,495	$80,552	$366,070
Network Installation & Parts:	$65,000	$25,351	$129,355
Classroom Displays, etc.:	$15,000	$4,433	$19,433
Peripherals (Printers, Scanners, etc.):	$30,000	$9,224	$40,720
Total materials	**$68,000**	**$19,153**	**$99,078**
Space Renovations:	$25,000	$8,915	$43,346
Software:	$30,000	$9,374	$41,868
Video Supplies, etc.:	$3,000	$865	$3,865
Other & Miscellaneous:	$10,000	$0	$10,000
Total other	**$20,000**	**$0**	**$20,000**

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7) Appendices

Tishman Project Faculty and Staff: 1991 - 1992

Victor Aluise	Computer Lab Consultant
Karen Bass	First Program Teacher
Rachel Bellamy	Software Usability Engineer
Steven Bender	High School English Teacher; *Playbill*
Mary Kate Brown	Middle School Social Studies Teacher; *Archaeotype* Designer
Luyen Chou	Co-Director of the Tishman Project; Associate Director of the New Laboratory for Teaching and Learning
Grant Courtney	Middle School Teacher
Jacqueline d'Aiutolo	High School English Teacher, *Playbill*
Tom de Zengotita	Co-Director of the Tishman Project; High School Philosophy Teacher
Monica Edinger	Middle School English Teacher
Malcolm Fenton	Middle School and High School Science Teacher
Jean Gardner	Environmental Studies Teacher, *Archaeotype*
Neil Goldberg	First Program Social Studies Teacher, *Archaeotype* Designer
Teresa Gonzalez	Assistant to the Director of the New Laboratory for Teaching and Learning
Eileen Gumport	Design Associate, First Program
Dan Kramarsky	Middle School Teacher
Bruce Long	Senior Design Associate
Robert Matsuoka	Manager of the Dalton Network
Robert McClintock	Co-Director of the Tishman Project; Director, Institute for Learning Technologies, Teachers College, Columbia University

Robert Meredith	High School Art and Architecture Teacher
Cybele Merrick	Administrative Coordinator
Frank A. Moretti	Co-Director of the Tishman Project; Executive Director of the New Laboratory for Teaching and Learning; Associate Headmaster of the Dalton School
George Mosler	Technical Support Coordinator
Philip Napoli	High School History Teacher, *Civil War Project*
Mollyann Pollak	Middle School Teacher
Joshua Reibel	High School English Teacher, *Playbill*
Toby Sanders	Computer Lab Consultant
Susan Schwarz	Tishman Project Secretary
Adam Seidman	Software Developer
E. Jay Simms	High School Art Teacher
Caren Steinlight	High School French Teacher
Malcolm Thompson	High School Science Teacher, *Project Galileo*
William Waldman	Software Developer