COMPUTERS IN THE CLASSROOM: ANOTHER CASE OF THE MORE THINGS CHANGE THE MORE THEY STAY THE SAME?

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CSE Report No. 238
1984

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The project presented or reported herein was supported pursuant to a grant from the National Institute of Education, Department of Education. However, the opinions expressed herein do not necessarily reflect the position or policy of the National Institute of Education and no official endorsement by the National Institute of Education should be inferred.

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Introduction

Consider the following--computers are changing the fundamental character of schooling; the microchip will dramatically alter the process of education; teaching and learning will be transformed by the power of digital technology. Familiar statements? Certainly. Widely held views? Of course. Supportable assertions? Well, a great deal of evidence of a micro-boom in school is all around us. But does all this activity mean that we are in the midst of an educational as well as technological revolution spearheaded by the microcomputer? True, we have as yet only glimpsed at what computers might be able to do educationally, but we've had some hard looks at booms and trends. We've seen booms burst; and we've seen trends nearly always end. If we judge from the computerized curricula we now have available, an educational revolution does not seem to be at hand. If the current use of computers in classrooms is taken to mean that we are experiencing a teaching and learning revolution, it is certainly one of micro proportions. If the character of schooling is changing, it is doing so only in the most superficial ways. If the microchip is altering the process of education, it is as yet only to the slightest degree. The potential for change may be enormous, but if we look closely at what actually happens now in computerized schooling it bears a striking similarity to traditional classroom practice. The infusion of computers into schools seems to be yet another case of the more things change, the more they stay the same.

How is it possible that sameness is the result of all the computer activity around us? Both rhetorical and physical signs of change abound! We know, for example, that computers are everywhere in schools. Early reports from a recent survey of microcomputer use in schools by Johns Hopkins University indicate that, as of January of 1983, 53% of all schools (public and private) had at least one computer for instructing students. Further, the study found a rapidly accelerating rate of computer acquisition by schools during the last two and a half years. Secondary schools are leading in the computer-acquisition race with over 85% of all senior highs having computers for instruction. Amazingly, the number of secondary schools with five or more micros doubled between June of 1982 and January 1983, with 40% of all secondary schools now having five or more micros (Becker, 1983).

Computer literacy courses have appeared everywhere as part of the curriculum, and computer literacy was named as one of the five new basics that should be required for high school graduation by the National Commission on Excellence in Education in its recent report A Nation at Risk (1983). Teacher in-service courses in the use of microcomputers proliferate in the most prestigious university schools of education, in the not-so-prestigious college weekend extension programs, and in the blatantly commercial storefronts and offices of hardware manufacturers and sellers. While these courses range widely in both their style and substance, "Don't be left behind" appears to be their most salient message. As the world is being revolutionized by computers, the future of schools and teachers, it seems, will be digital as well.

In a more subtle, but equally potent form, the message is sounded in the onslaught of hardware and software and salesmen who wax eloquently, if not always intelligibly, about bits, bytes, roms, rams, and the ideal number of K. At a recent conference attended by over 3,000 computer-using educators, the traditional separation between scholarly and commercial presentations was blurred, and few seemed to question the mixing of the two. Also noticed was a curiously hard version of soft-sell. "Yes, there is little in the way of truly useful software on the market," those attending the conference were told. "No, computer literacy is not the way to go," the experts said. "Why get a machine to do what a human can do better, more sensitively, more cost-effectively?" All agreed. "I can't spend my budget; there's so little worth buying," was a frequently heard complaint. Yet there was no doubt amidst the sharing, showing, and selling that software budgets would be spent and machines would be bought as soon as the manufacturers could get the newest versions to work properly.

How is it possible that computerized education could even begin to resemble, let alone replace, human-to-human teaching and learning. "Not to worry," teachers are constantly reassured. Computers are not the smart machines we sometimes give them credit for being; computers only know what humans teach them. Computers will never provide the multiplicity of modes and responses that a sensitive human teacher has at his or her fingertips. Computers will never be able to respond appropriately to the divergence in students' creative output, to weigh carefully the distinctions in differences of opinion, to interpret carefully in questions of values, or to ferret out a complicated thought process. Computers will never communicate the joy of discovery and the pleasure of watching and helping someone learn. Teachers will always be required for those subtle and complex interactions thought to be the heart of the teaching/learning process.

A Picture of the Classroom

But are these human interactions, in fact, at the center of teaching and learning in classrooms? Those of us who analyzed the data about the teaching and learning process in the 1000 classrooms that constituted the sample for A Study of Schooling found something quite different from this ideal picture of classroom instruction (Goodlad, 1983). Teachers who employed a wide variety of instructional strategies or arranged for students to experience a variety of learning modes were extremely rare. Rather, with an amazing consistency, teachers across the grades and in nearly every subject area relied on two dominant instructional configurations--1)lecturing or demonstrating to the whole class, and 2) having students work alone using texts or workbooks or worksheets.

Teaching was almost exclusively the presentation of information. Learning was nearly always seen as the passive intake of information or as practice. Within these two classroom configurations, teachers out-talked their students by a ratio of nearly three to one. Importantly, most of this teacher talk consisted of telling--the presentation of information. Less than 6% was in the form of questions. During the small amount of questioning that took place, less than one sixth of the questions were of the open-ended variety, those which require students to respond in complex ways--to evaluate, to analyze, to react. Most questions required answers like "yes" or "no" or specific facts like "Columbus" or "1492" (Sirotnik, 1983).

Further, we found in these classrooms an emotional climate that can best be described as flat. Little in the way of warmth and enthusiasm, encouragement or praise, was expressed by teachers. Nor was there evidence of much eagerness, curiosity, or overtly positive responses by students. Happily, overtly negative behavior was noticeably absent as well. But it is disconcerting, at best, to think of 95% of teaching and learning taking place in an environment so neutral that it is hard to believe that anyone cares very much about what is going on.

For the most part teaching and learning activities were traditional and passive--teachers lecturing and students listening, or students working alone on written assignments. Rarely were more active learning modes found. Chances were less than 8% that students in these classrooms would be involved in discussion, simulation, role playing, or demonstration. Students worked cooperatively only 10% of the time.

Passive instruction is not news. Studies as far back as the turn-of-the-century report this familiar classroom scenario (Stevens, 1912; Hoetker & Ahlbrand, 1969). But the evidence certainly does cast doubt on the important and central role in classrooms of the kinds of subtle interactions we say we value in teaching and presume computers cannot duplicate. These uniquely <u>human</u> qualities may be more instructional myth than reality.

Current Uses of the Computer

The computer is a device which allows students of varying abilities to cover various materials at varying rates. The key word here is vary (we suppose <u>individualize</u> hints too much of the "flaky sixties"). Let's look at what is being varied and for what reasons. Does this variety benefit the student by accommodating varied learning styles and encouraging more active modes of learning, or does it benefit the teacher by allowing greater ease in following traditional modes of teaching? A look at the most common types of computer-based materials will help us answer this question.

Drill and practice: Drill and practice is the predominant mode of computerized instruction in use today. Its roots can be traced to the teaching machines heralded in the 50's and trashed in the 60's. Students may be asked to answer math problems, choose the correct spelling for a word, or fill in holes in sentences. The key seems to be the ease with which an answer can be marked right or wrong. Any objective knowledge that can be memorized, spit back, and easily judged for correctness is prime material for a drill and practice program. Not only are companies beating down classroom doors to sell software drills on every conceivable subject, but teachers who have developed their own simple drill programs are joining the commercial competition as well, either on their own or through software houses. Advertisers are touting the phrase classroom tested, as if this label has a bearing on the appropriateness of the programs. Recently, classroom tested drill and practice courseware has been enhanced with the addition of limited authoring capabilities which allow teachers to type in their own lists of questions and answers so that the materials can be more easily tailored to a particular course. This makes the programs a bit closer to what those teachers have been doing already. Some revolution!

Who benefits from these drill and practice programs? Does the student learn more or better with the questions on a screen instead of in a workbook? Although students may be more motivated when they see their name on TV, for how long will this fascination last in today's world of video games and space technology? It may also be argued that the learning is more individualized because students can study different lists, but is a computer really necessary to accomplish this task? It definitely is easier for the teacher with the computer, as the record-keeping capabilities of many courseware packages free the teacher from such chores. But does this alter the educational process, or is it just more of the same in a new package?

Tutorials: In the tutorial instructional mode, the computer lectures to the student on topics ranging from spelling rules to nuclear fusion. If drill and practice is linked to electronic workbooks, tutorials may be compared to electronic textbooks. A typical program leads a student through the material being presented, the only variable being speed based on individual reading rate. This approach may be worthwhile if the material is graphically presented on the screen in a way superior to the chalkboard, film, video, books, etc. More elaborate tutorials allow students to repeat sections they are not sure of, but few programs help students decide when repetition is desirable. The only variables are those that relate to how fast the student reads, and how quickly the material is understood. Everyone goes through the same material presented in the same way. Student conscientiousness and study habits probably account for more program variation than student learning.

Who benefits from these tutorials? Certainly not students whose reading level may be below the comprehension level for the material being presented. Furthermore, it is doubtful that other students will learn more than they could from a live presentation which might encourage more active learning modes such as discussion, questions, and interaction with other students. On the other hand, the teacher does not need to prepare each demonstration or worry about repeating the demonstration for absent students. Even slower students are provided for: "If they do not get it the first time, let them view it again, the computer is patient."

Again, the tutorial programs, like drill and practice, seem to make it easier for teachers to retain status-quo teaching strategies. The primary modes of teaching have not really changed--only the labels applied to them. Teacher lecture has given way to a slicker computer lecture, and workbook drill has been replaced (or in many cases augmented) by electronic drill. And what of the flat, uncaring tone present in the traditional classrooms? It is folly to suppose that a computer can express more in the way of warmth and enthusiasm, encouragement or praise, than a human teacher, though some programs come in gift boxes and psychedelic ribbons few humans can match.

Educational Improvement and the New Technology

Given this somewhat dismal picture of the current state of classroom instruction, both computer-free and computer-based, what hope can we have for significant educational improvement via the technological revolution? Surprisingly, perhaps, quite a lot. Two factors currently present in the computers-in-education movement have potential for promoting fundamental school change. The first is the fact that computers have entered the schools in a big way, both in the actual number of people and schools affected and in the tremendous interest in the technology itself. The second factor is that the computer's potential for making possible new modes of effective instruction and learning is great. But, unless schools become receptive

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to--indeed, bring about--fundamental changes in the way they do their work, this educational potential has little hope of realization.

Let us look a little more closely at why these two factors are conducive to school improvement. The first--the big deal surrounding the widespread adoption of computers--indicates that the prevailing view among both school practitioners and the general public is that the computer represents both a substantial educational challenge and considerable educational promise. Why does this seem to make change likely? Certainly, conventional wisdom would lead us to assume that larger changes are more difficult and more easily resisted than smaller ones. However, there is evidence to the contrary. For example, the Rand Corporation's study of factors affecting the implementation of federal programs supporting educational changes in the 70's found that the amount and complexity of change required of teachers in their classroom procedures was <u>positively</u> related to the likelihood of change taking place. The dimensions of those large scale projects that resulted in more overall change included changed classroom organization, curricular revision, and considerable extra effort required by teachers (Berman & McLaughlin, 1975). Clearly the infusion of computers into instruction in existing school subjects involves all three dimensions. The physical presence of the hardware itself requires some organizational rearrangement; the curriculum is certainly revised, if only in mode of presentation; and finally becoming not only computer literate, but a computer teacher, requires considerable effort beyond the usual daily work of teachers. What can happen, given the right context--a matter that we will return to shortly--is that as these "adjustments" are made, more profound changes can occur. Once we are in the midst of physical and organizational rearrangements, other areas of the curriculum come under scrutiny.

We know that physical arrangement of the classroom has substantial influence on its social organization. So, while we are moving the furniture, we might reflect on what types of configurations support the kinds of human interactions that are most conducive to academic learning and to the social and personal development of students. For example, the power of cooperative learning groups might be explored with small groups of students working with a single computer terminal. Further, as we alter the mode of instruction from textbook/workbook to software we might consider whether the content we now teach is what we really want students to encounter. We might even question whether we want to continue to view learning as the relatively passive acquisition of knowledge created by others. The "big deal" surrounding computers in schools, then, gives some hope for significant educational change.

Second, while as yet not used much, the technological capabilities of computer hardware and software bring some new effective teaching and learning modes within reach. Programs are beginning to appear which encourage the use of higher-level learning skills instead of just testing recall. These "new-breed" programs are called simulations and, as the name implies, they try to simulate either realistic problem-solving situations, or encourage the manipulation of objects in a highly controlled, self-contained mini-world. These programs offer students classroom experiences which never were available before computers. A graphic journey through the human body or the workings of an internal combustion engine can be controlled based on a student's response in given situations. The learning potential of these new modes is both exciting and challenging to educators (see for example, Dwyer, 1980).

One of the most common forms of simulation is the adventure format, where students take on the role of an explorer or fictional character and plan strategies to solve problems which are thrust upon the character. What a wonderful opportunity for groups of students to interact and cooperate in problem-solving situations. But how are adventures currently being used? If they are used outside of normal classroom hours or as a reward for "faster" students who finish their normal assignments, then the students most lacking in these problem-solving skills are the students least likely to use these programs.

The most well-known of the "mini-world" simulations is the LOGO language, developed at MIT over the last two decades. In the "world" of turtle geometry, a turtle pointer moves about the screen drawing lines depending on instructions provided by the computer user. One of the important characteristics of this is that beginning from the earliest simple instructions to the turtle the user gradually develops a full-fledged computer language which can be used for many non-turtle applications. Procedures--program instructions developed by students (i.e., the steps the turtle must go through to draw a square)--can be given a name and nested in the computer to build other, more complex procedures. The potential is great for LOGO (Papert, 1980), but today it is used almost exclusively by individual students for creating geometric drawings. Little of the rich verbal interaction of which the language is capable is currently being exploited. Probably because LOGO goes beyond familiar classroom practice, teachers seem to limit LOGO's use. Potentially revolutionary, LOGO's full potential has yet to be realized in today's school.

The complex nesting structures of LOGO can be used to significantly enhance traditional CAI programs as well. Take a traditional tutorial program and add the ability to evaluate progress and nest sub-programs, and you get a sophisticated system that can address individual differences. Such a program can identify a student's difficulties and branch to sub-programs which address particular areas needing remediation. Programs of this scope generally are available only on large mainframe or mini-computers, as the memory needed to store all of the sub-programs is greater than that currently available on individual micro-computers. Yet, when clusters of micros are networked to a hard disk drive there is access to hundreds of times more memory than is contained within the single computer itself. Once hard disk drives make their way into school computer use, at least the technological barrier to rich multi-level courseware will have been overcome.

Other technological innovations to use the basic microcomputer include speech capabilities and light pen devices which allow simple and quick interactions by just touching the screen with the pen. In addition, video disk interfacing holds tremendous promise for classroom utilization, and as the component prices lower and the sophistication and access speeds increase, we can expect to see more multi-modal instruction which will address many more learning variables that can now be addressed.

But, of course, just because an innovation is perceived as large in scope and has the inherent capacity for significant educational change, it does not follow that change automatically occurs. We have a long history of just such innovations that resulted in very little alteration of either the content or mode of schooling. The "new math" of the early 1960's is probably the most frequently cited "failed" innovation with so much educational promise. But there are many others: open classrooms; non-graded schools; team teaching; PSCS Physics. Anyone in schools during the last twenty years could easily expand this list. Probably closest to computer-based instruction is, of course, educational television, a widely heralded technological innovation that became a costly and embarrassing schooling flop.

Implementing Change

What happened? These educational innovations did not suffer from the lack of good ideas, nor from the absence of considerable enthusiasm about them. What was missing was an appropriate perspective on how change happens in schools and the specific implementation strategies that flow from it.

The introduction of school innovations for the last twenty years was guided nearly exclusively by the Research, Development and Diffusion model. The RD&D process usually begins with the development of a sound educational innovation that meets the needs of schools. However, it is policy makers who study the innovation, determine its effectiveness, and mandate its implementation. But what of the people, primarily teachers and students, who are in schools, and the objects of the proposed change? The innovation loses its power because it gets disseminated by "experts." Usually, it is presented as the answer to particular problems, an answer that consists of a list of specific teacher behaviors and classroom or school characteristics. The "expert" sets about to have school people understand, or at least adopt the changes, with little, if any, input from teachers. Input, when it is solicited, is usually gathered after the genuinely important issues have been settled.

Innovation brought to schools in this way comes from available research and development outside the school. Different marketing strategies are used to "sell" innovations to individual teachers. Schools, then, become passive targets for particular innovations. A single aspect of the school or classroom comes under close scrutiny as the focus of innovation. Thus, innovation tends to be applied to isolated elements, rather than integrated into the whole of schooling. When attention to the innovation subsides, as it usually does before long, attention to that part of schooling diminishes also. Ways of getting teachers to change, rather than changing the conduct of schooling itself, are the focus. The RD&D perspective is lacking because both its focus on changing individual teachers and consideration of only a small part of the school's functioning do not contend with the realities of how schools resist or effect change (Goodlad, 1975; Sarason, 1982). Most of the reforms of the 60's and 70's assumed an RD&D perspective. Consequently, these innovations did not effectively penetrate the classroom.

Following the argument laid out in Goodlad (1975), an alternative approach to school change proceeds from a culturally responsive perspective. The differences between this view and RD&D are several and important. First, in the culturally responsive view the purpose of change activities is to create a self-renewing school--a school staff that works together to examine the conditions of the school, identifies problems, and develops alternatives based on their own experience and on research in the field. The self-renewing school may use ideas from the outside, but the intention is not to make the school a better target for innovations developed outside of the school.

Second, the primary focus is on the dispositions of teachers and others in the school toward the processes and concepts of change rather than on changing specific structures or teacher behaviors. Having the school staff critically examine the assumptions they hold about how schooling should and can best proceed, together with information about what actually happens, is a necessary condition for bringing about solutions that respond to the problems schools face. But, since schools are vulnerable to social and political pressures from both inside and out, the culturally responsive perspective recognizes they need a great deal of support and encouragement if they are to attempt anything beyond day-to-day survival (Heckman, Oakes, & Sirotnik, 1983).

The first crucial factor, then, when schools themselves begin to implement "innovations" such as computer-based or assisted instruction, is the ownership of the innovation by the staff, including an active role in the development or adaptation of the substance of the innovation as well as in the plans for implementation. Second, a great deal of support must be available--support that is viewed as long term and non-judgmental. This support can be viewed as a scaffolding built around a school to both support it during the change process and to protect it while it is particularly vulnerable.

How then does this culturally responsive view translate into ways schools can successfully integrate computer courseware into their curriculum? First, those at the school must be central in designing or adapting the "substance" of the courseware itself, making it appropriate to the needs of the school and its students. In this way, not only is an appropriate innovation developed, but it is one "owned" by those who will use it. Second, these efforts must be supported at the school with time and resources for the development activity and with a sense of the importance of the project. In addition, support in the form of ideas or resources from outside the school can help raise the substance and the process of the innovation beyond conventional wisdom and common sense assumptions that develop when a school staff is isolated from theory and research.

What are some of the practical considerations which will arise when teachers examine the curriculum in light of the current research and their own experience? If lucky, the determination of those areas most in need of change will include areas which may be seen as "easy" to change. Here, "easy" corresponds with local control; that is, the internal programs and processes controlled at the school level such as bell schedules, room environments, and student tracking traditions. If the staff, teachers, administrators, and parents work together, such logistical features can be altered as part of an overall implementation strategy.

But the more substantive type of change is also critical and probably more difficult to accomplish. A change in the substance of the curriculum usually collides with rather rigid counter-expectations at many levels of the educational and social community. The school district office, for example, will have to contend with its schools diverging as they meet broad district goals in ways consistent with the unique needs of and talents at

Traditional divisions must be bridged with communications such that one does not encourage curricular change while the other resists it.

But even with all of these elements in place, will teachers be able to create intelligent, exciting, and sound computerized educational programs? Although many teachers claim that they have written such materials, there are very few programs that can function both as integral parts of the curriculum and as thought-provoking, active learning tools. A teacher generally will not have the programming skill needed to make a program exciting, while a programmer, although well versed at graphics, animation, and sound techniques, will usually not have the background and experience to develop programs that are both educationally sound and uniquely fitted to a community or school's classrooms. Traditional authoring programs may include some benefits of both professional programmers and educators, but nothing exciting or <u>important</u> has yet been produced by such structured programs.

Much earlier we asked a <u>conventional</u> question about how computerized education could resemble or replace human-to-human teaching and learning. We have eroded the significance of that question with reference to the work of Goodlad and others which suggests that much of what is known to be the strength of that "human-to-human" interaction doesn't occur very often in classrooms anyway. An interim conclusion we can draw is that <u>if</u> education <u>could</u> approximate current human-to-human teaching, and in someways it can, then not much would be benefitted or lost because truly significant lasting <u>changes</u> rarely take place in schools. We then introduced what we and others have found to be true about how change <u>can</u> take place in schools, and we are prepared to offer a new question: How can the spirit of innovation and enthusiasm for change associated with the computer technology bandwagon complement long-needed changes within the educational community? Stated practically, "How can we keep computers in the classroom as one vital component of meaningful school improvement and out of the closet with the learning kits, teaching machines, video equipment, and other flotsam of failed innovations?"

Exemplary Computer Curricula

At UCLA's Laboratory in School and Community Education a project now underway attempts to confront the problems and possibilities of school change with computerized education. Using the culturally responsive view of school change as a model, the central purpose of the project is to investigate whether a collaboration of public school teachers and university-based researchers can result in the conceptualization, development, and implementation of exemplary computer curricula in basic subjects at local school sites.

The work of the collaborative team did not begin with the development of courseware, however. An intensive examination of current curricular beliefs and practices, a survey of research and theory in language arts and mathematics education, and the conceptualization of what curriculum would be "ideal" for students preceded any computer-specific work. The team did extensive reading in the area of computer applications in education and surveyed the extant curriculum software as well. In other words, the essential elements of the culturally responsive perspective on change constitute the heart of the project: The examination of current school practice; the critical scrutiny of assumptions about what teaching and learning should be, and the local development of educational alternatives.

During this initial phase of the project, careful steps were taken to insure that the necessary supports for project schools were secured. Both district and site level administrators were a part of the initial conceptualization of the project itself and made a substantial commitment to the importance of the project to their schools. In addition, certain material resources have been designated for project user. The school districts agreed to provide both time and resources (principally equipment) for the project teachers. The school principals arranged working space at each school and facilitated release days for meetings of the entire team. These internal supports help the teachers view their involvement in the project as meaningful and the results of their work as important to their schools.

Additionally, the Laboratory at UCLA provides additional support and resources. Five weeks of intensive planning, reading, thinking, and discussion for the entire team were provided at the Laboratory before the project year began. The teachers are considered part of the Laboratory staff as well as members of their school faculties. Summer salaries and part of their teaching salaries are paid from project funds. Importantly, the involvement of the university begins to provide the necessary scaffolding of support for schools where teachers are attempting to try new ways to confront educational problems. The researchers, too, provide access to ideas that go far beyond conventional wisdom and common sense assumptions about teaching and learning in language arts and mathematics and about the use of computers in schools.

During the development phase, work of the project takes place at both the university and at the school sites. The first activity of this phase was the teachers' translation of the "ideal" curricula--conceptualized during the summer--into learning experiences that could be "tried out" in their classroom. Following these trials the series of lessons were examined as to how computers might enhance them and, of course, the learning of students. By developing learning activities from a computer-free perspective, the project is driven by curricular ideas rather than by the limitations of computer technology. Throughout the project we are careful to address curricular issues first, and then try to adapt the technology of computers to them.

An experimental authoring <u>system</u> which allows considerable curricular flexibility while providing the best of the microcomputer technology--color graphics, animation, and sound--is being used by the teachers to adapt their curricula to computer courseware. The system is sophisticated enough that students can be lead through the curriculum in a manner which allows for their varied learning styles and backgrounds. Branching and nesting of programs enable <u>all</u> students to experience a common curriculum without the "holding back" or "hopelessly lost" syndromes teachers are afraid of in heterogeneous classrooms. Exciting lessons and graphics are relatively easy to create, without the need for professional programmers.

Later in the project the team will "try-out" these computer-based learning activities with students, and will draw comparisons to determine the relative strengths and weaknesses of the computer and non-computer learning activities. As the project continues, team members hope to develop their knowledge of how computers can assist in carrying out the "ideal" curriculum and with increasing skill create computerized learning experiences toward this end.

By addressing the process of change in a way that will encourage teachers to own the innovation and providing them considerable support, the project seeks to allow teachers to explore and consider changing areas of the curriculum that have resisted change attempts of the past several decades. We hope that we can, through this process of change, and aided by the awesome potential of the computer, create a self-renewing environment in our project schools that will make future change a much easier and non-threatening task.

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